ILLUSTRATED
ELECTRICAL REVIEW
A Journal of Scientific and Electrical Progress.

VOL. 30. No. 7. WEEKLY. | NEW YORK, WEDNESDAY, FEBRUARY 17, 1897. | $3 PER ANNUM. Single Copies, 10 Cents.

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VIEWS, NEWS AND INTERVIEWS.

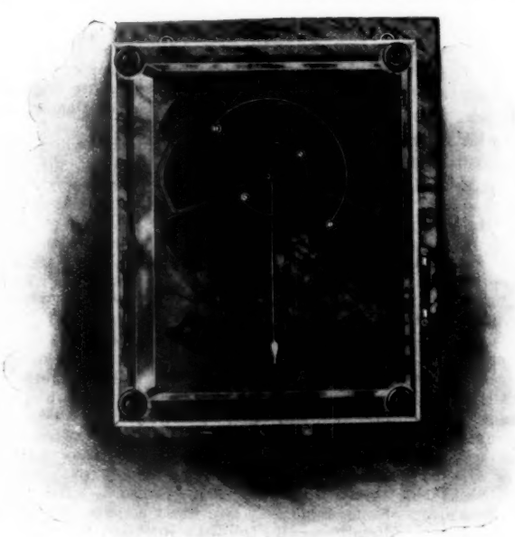
One Edward Bond, of Anderson, Ind., has served notice on the English syndicate not to pay George Bramble, of Sleepy Eye, Minn., the $2,000,000 deferred payment for the patents on a machine which applies steam power direct. It is claimed the patent brought $7,000,000. Bond invented and patented a machine in 1885, which, he asserts, covered all of the points in Bramble's invention. We wonder if Bramble has been paid his first millions!

The Court of Appeals, of Maryland, held, in the case of the Baltimore Traction Company vs. Helms, that where one deliberately walks out from behind a street car from which he has alighted, and attempts to cross a public street without using his powers of observation, and is injured by an approaching car, which injury could have been avoided by the use of the most ordinary care, he will not be allowed to recover. The Court said it did not intend to lay down the same rule of conduct as always applicable to the crossing of tracks of steam and street railways, and added: "The legal duties and correlative rights in the two cases are not the same, and what might be negligence in the one case would in the other, under some circumstances, be held to be but the exercise of a legal right."

Probably the largest X-ray coil is the one recently completed for the Western University, under direction of Professor Fessenden. It is wound with 50 miles of small wire, and is arranged to give a spark over 20 inches long, while the capacity of the machine reaches 30 inches. The current is received from two portable storage batteries.

A novel use of X rays is reported in England. A lady, while baking some cakes, lost her ring in the paste, but did not discover the loss until the cakes were out of the oven. Afraid of choking some member of her family, she struck on the happy expedient of taking the cakes to a chemist and photographer, who placed them under the X rays, with the result that the ring was immediately located and removed.

W. J. Arkell, publisher of *Judge*, started a balky horse by filling its nostrils with sand, and announced to the applauding street crowd that he "did not read London *Lancet* for nothing"! This great medical journal will suddenly achieve distinction as a valuable equine publication.



THE S. K. C. STATIC GROUND DETECTOR.

Time of Exposure in X-Ray Work.

TO THE EDITOR OF ELECTRICAL REVIEW:

In the abstract of X-ray paper read before Franklin Institute, and concluded in your issue to-day, I read that the writers "have very carefully investigated every claim to quicker exposures than these (30 minutes for the trunk at 12 to 15 inches), often by a personal visit, sometimes by correspondence with personal friends, whose reliability was undoubted. We have been unable to learn of any results equally good having been obtained in shorter time by any one, at any place, with any form of apparatus, and we do not believe any such have been obtained."

I am surprised to read that more than "a few seconds" is really required to take a good negative of the trunk of the body.

In the vast rush of miracle-workers into print the writer has felt himself to be but a modest follower, far in the rear of the average X-ray magician. It never occurred to me to report that on September 20, 1896, I took a 14 by 17 negative of metallic objects through the trunk of a fully dressed adult in five minutes—tube, 13 inches—in front of the person's chest, objects secured to clothing behind the spine. My students and visitors who look at the print say it is as good as any they ever saw anywhere.

It can be seen by any one who wishes, and I have demonstrated and taught to my pupils in X-ray work that five minutes, a good tube and a good operator will suffice for the trunk. Exposure time is dependent on the tube.

The assertion in your journal seems to be authoritative, and I therefore conclude that others are not so far ahead of what has long been routine work with me as I supposed. My experience daily discloses the additional fact that very few know what high-grade X-ray work is.

Respectfully,
S. H. MONELL, M. D.
Brooklyn, N. Y., February 10.

STATIC GROUND DETECTOR.

GENERAL INSTRUCTIONS FOR USING AND INSTALLING.

The new ground detector, manufactured by the Stanley Electric Manufacturing Company, of Pittsfield, Mass., is essentially a differential static voltmeter, made up of four vanes fixed to a base, and a movable vane carrying an index, or pointer. The movable vane is made of sheet aluminum, mounted on a shaft and held centrally by two jeweled bearings between the fixed metal vanes. The diagonally opposite fixed vanes are connected in pairs, and each pair is statically charged from one pole of some source of electrical supply. The movable vane, which is connected to "earth," is inductively acted upon by each pair of fixed vanes, so that the stress produced by each is equal, but opposite. The movable vane, in consequence, takes a position equally between the fixed vanes, which position is, theoretically, the same, whether the instrument is charged or not, and is the position of "no ground", the pointer pointing to the zero of the scale.

If one pair of fixed vanes and the movable vane are electrically connected, they are charged of like character from one pole of the source, the other fixed vanes being charged of opposite character from the other pole. The action of the similarly charged vanes is to repel the movable vane, while the action of the other fixed vanes is to attract it. The two forces acting in the same direction, the movable vane takes the position entirely within the oppositely charged vanes; the pointer pointing to the side of the similarly charged vanes and pointing to the position of "ground" for that side.

The static ground detectors are made in three types, as follows:

Type A, for use on any two-wire or four-wire circuits of any electro-motive forces over 500 volts and under 5,000 volts, and for three-wire, three-phase circuits of the same voltages.

Type B, same as type A, except for electro-motive forces of 5,000 volts and higher.

Type C, for use only on three-wire, two-phase circuits, and for electromotive forces over 500 volts and under 3,000 volts.

The general appearance of all instruments is the same, differing only in detail. There is no connection through any of the instruments between the line wires or between either of the wires and earth. It is not necessary to first introduce a temporary ground on the line in order to test for an existing ground, the characteristic defect of the old forms of ground detectors. This feature is of great importance, as it insures greater safety to linemen and lessens the possibility of short circuits in the instrument itself.

The instrument consumes no energy, and may be left continuously in circuit, indicating grounds as soon as they occur. An instrument for each circuit may therefore be used to great advantage.

In places where severe lightning storms are frequent, and where the line is not adequately protected by lightning arresters, it is advisable to disconnect entirely the ground detector or open the "permanent ground wire" during such storms.

Type A is mounted on a separate marble base or directly on the switchboard. It is entirely covered by a case of plate glass, and all parts are perfectly insulated from the operator. In setting up the instrument it is necessary to see that the shipping attachment is removed, so that the pointer swings freely, and that the instrument is level, so that the pointer will stand at zero when at rest. The line wires are connected by small terminal plugs, through removable fuse blocks on either front or back of the instruments, to the fixed vanes. By inserting a commutating switch between the line wires and the instrument it may be transferred safely and quickly from one phase to another or to any one of any number of circuits.

Type B differs slightly in construction from type A, in that the line wires are connected to a primary set of vanes, which are behind the visible fixed vanes, and are separated from them by large plaques of hard rubber and mica. The visible fixed vanes are charged inductively from the primary vanes instead of directly from the lines. This type of instrument is mounted on a mahogany base in which are embedded the primary vanes and the mica plaques. This construction secures perfect insulation for very high voltages, while in general appearance and in action the instrument is the same as type A.

Type C, ground detector, in construction and in appearance is practically the same as type A, differing only in having the vanes connected to the outside wires partially cut away.

It is stated that this is the only ground detector that will work properly on a three-wire, two-phase circuit, as all others always indicate "ground" on the middle wire, whether there is one or not, on account of the unequal electro-motive forces between the wires. The relative potential of the middle wire of a two-phase circuit is dependent upon the capacity with respect to the earth, and this, in turn, upon the extent of the lines and their distance from the earth. For very short or very long lines, therefore, special adjustment may be necessary in order to make the instrument indicate correctly, but generally the standard type C instrument will meet all requirements, and is furnished unless special instructions are given.

Fuse wire used for all ground detectors is the well known platinum-silver wire used in Cardew voltmeters. All ground detectors are properly fused before leaving the factory, and an extra length of fuse wire is furnished with each. If more is needed it can be obtained from the factory or from any electrical supply house. The ordinary lead fuse should never be used.

MUNICIPAL OWNERSHIP OF ELECTRIC LIGHTING PLANTS.

SUPPLEMENTARY COMMITTEE REPORT READ BEFORE THE NORTHWESTERN ELECTRICAL ASSOCIATION AT MILWAUKEE BY ELIHU COLEMAN, JANUARY 20, 1897.

It is a question of the gravest importance, both to central plant owners and to the tax-paying people, and the subject should be approached broadly from both standpoints.

If the municipal lighting movement is right, we gain nothing by kicking, but will be injured by reaction.

If that movement is without proper foundation, it must be met by facts and figures.

Probably the majority of electric plants to-day were installed on a fictitious basis, with the capital stock much above the actual investment. Confidence in these investments was lost, and even clean, honest securities could not be placed, and are still at heavy discount.

The third era of the business is now on, and the bondholder, the creditor, the purchaser at foreclosure sale and the honest investor are now on deck, with the full understanding that only honest work will bring good results.

We must meet the agitators for municipal ownership with open hands, and when they think judicially on all sides of the question the agitation will cease.

Waterworks corporations and lighting corporations are, from their very nature, quasi-public corporations. They can not operate without a franchise from the municipality. The city signs it for two reasons: First, that private parties shall put in the capital and produce the electric current to light the streets and public buildings, and, second, to light the houses and business places of the citizens.

If the company does its work well and in good faith, it has a right to expect good faith from the municipality.

The company pays its taxes, furnishes good light, and is a booming card for citizens to boast of.

Is it equitable on the part of the city to enter the field against such a company and as a competitor to it merely because, with its help, the city treasury has become plethoric and it can build its own plant?

On the other hand, if the company, after receiving its franchise, has only played the rôle of a leech, then the city fathers should cause its franchise to be judicially annulled and proceed to build its own plant, or, to do what is better, contract with a reliable company to furnish the city and its citizens with equitable but living rates.

All will agree that it has neither the moral or equitable right to do so.

It is, therefore, certain that the municipality should not be given the power to put in plants unless, first, the existing companies shall be bought out; or, second, their stock bought up; or, third, if agreement of purchase can not be made, that process of condemnation be had under power of eminent domain, as in railroads.

While hardships might come to some, these methods would all be fair and equitable.

The remaining questions are these:

1. Is municipal ownership practical?

2. Will it be remunerative?

The office of a town or city is not to dig our potatoes, cut our wood, or chop our hash, or to do any of the ordinary work of life, excepting, of course, to furnish lawyers with law suits; but its office is to do for all its citizens such work as individuals or corporations can not do for themselves, such as furnishing protection, building and maintaining streets and furnishing water and lights, and the two latter can better be done by the quasi-corporation in most cases than by the city itself, and these franchises are given to these corporations to relieve the city of an additional swarm of blood suckers—both political and personal.

In the financial phase lies the greatest objection:

1. A commission (non-partisan, of course) must be appointed.

2. A manager must be hired.

3. An expert electrician must be had.

4. Duplicate machinery must be put in, for commissions, boards of experts and common councils can keep no pace with electrical currents, machinery or men.

5. If the public plant furnishes electricity for private consumption, the sucker citizen will forever be hounding the manager for rebates political, rebates special and rebates on general principles.

6. The manager and manufacturer will put their heads together to fool the board, and the public bleeds at every pore.

7. If the ever-alert central plant manager can not keep pace with the rush of improvements, where will the foregoing crowd be left?

Our hasty conclusions are, then, as follows:

1. That legislatures should grant no powers to municipalities to erect and maintain lighting plants for general use unless, where franchises have been given, the owners of the same shall have been remunerated as herein set forth.

2. That honorable manufacturers will not sell to municipalities until these steps have been taken, and central station men can not afford to deal with manufacturers showing themselves thus dishonorable.

3. That if we can not show to municipalities that the business is unprofitable to a city, including, of course, the item of taxes, lost interest on investment, depreciation, etc., etc., then we should be silent.

The Central Electric Company, of Chicago, report that one of the good signs of the times is found in the fact of increasing sales of all kinds of construction and line material. This would indicate a strong probability of lively business when the season fully opens up.

ELECTRIC LIGHT FLASHES.

The Scranton, Pa., electric heat, power and illuminating plant has been destroyed by fire. The work of rebuilding was begun at once.

A bill compelling all trolley and electric light wires to be placed under ground has been introduced in the Illinois Senate by E. J. Dwyer, of Chicago.

The Athol, Mass., Gas and Electric Company is placing on the market $40,000 in first-mortgage, 6 per cent, 5-20-year gold bonds. The gross earnings last year were $19,765, the operating expenses, $14,519, making the net earnings $5,246.

At the annual meeting of the Jamestown, N. Y., Electric Light and Power Company the following were elected directors: William N. Gokey, N. W. Gokey, George F. Gokey, C. W. Grant, W. F. Bushey. President, William N. Gokey; secretary, W. F. Bushey; treasurer, George F. Gokey.

Amendments to the charter of Martinsburg, W. Va., have been presented to the legislature now in session, asking for more extensive municipal power and the right, after being submitted to the voters, to issue bonds not to exceed $50,000, for the purpose of building and equipping an electric light plant. At present the Martinsburg Electric Company—a stock company—furnishes the light.

The stockholders of the Somerville, Mass., Electric Light Company at their annual meeting elected the following board of directors: David Cummings, H. M. Moore, J. H. Flitner, W. L. Hooper, L. E. Merry, E. L. Churchill, G. B. Neal, George M. Starbird and E. S. Sparrow. Mr. Cummings was re-elected president; Mr. Flitner, vice-president, and F. Ellwood Smith was elected clerk and treasurer.

The annual report of the board of directors of the Edison Electric Illuminating Company of New York city is printed in pamphlet form and is a very complete and interesting document. The satisfactory use of the storage battery in this great lighting system is mentioned in the following: "The modern equipment of Twelfth street station, including the storage battery, the turbo-generator and the water-cooling tower, has shown most interesting and, on the whole, satisfactory results, although there have been some drawbacks in the handling of all these new classes of appliances, as is usually the case in pioneer work. By help of the storage battery at Twelfth street, the generating plant of the entire system, with the exception of that of the Twenty-sixth street station, was shut down on several occasions over night or over Sunday, for the purpose of testing the practicability of running the entire system from one generating plant during the hours of minimum load. The results show that this is quite practicable, and, with the aid of the new storage battery in the Bowling Green annex, it is probable that considerable improvements in economy will be developed in this way during the coming year."

Electric Railways.

There is a bill before the New York Legislature at the present time to compel all street motor-car companies to put vestibules on their cars.

The Worcester, Mass., & Marlboro Street Railway Company has purchased a lot of land in Northboro, upon which a power-house will be erected at an early date.

The gross receipts of the Milwaukee Electric Railway and Light Company from its passenger business during the 12 months ending December 1, 1896, were $1,211,763.29. The gross receipts of the Milwaukee & Wauwatosa line were $12,182.13.

The Metropolitan Street Railway Association, composed of the employés of the Metropolitan Street Railway Company, of New York, enjoyed an illustrated lecture on electricity last Saturday night in the club-room, delivered by Prof. W. H. Knight. Mr. H. M. Littell, vice-president and general manager of the company, is president of the association, and Mr. E. C. Looker is the secretary.

Among the electric railway lines now prospected in the State of New York are the following, on which operations will probably begin in the Spring: Elmira, Watkins, Savona, Penn Yan, via Lake Lamoka; Branchport to Penn Yan, via Keuka College; Cayuga Lake to Auburn, Geneva to Sodus Bay, via Lyons to Palmyra. Companies have been formed for the construction of these roads.

One of the greatest street railway enterprises ever undertaken in this country is that for which the contracts have just been let in Pittsburgh, Pa. It involves the construction of a steel suspension bridge 2,000 feet long and the driving of a tunnel 1,700 feet long. The total cost will be $1,500,000. The line will run from Carnegie, where the big steel works of Carnegie are located, to Pittsburgh. The power used will be compressed air, and the line will run on an elevated steel structure through a private right-of-way to a mammoth suspension bridge 2,000 feet long across the Monongahela River.

The contract for a new power station, to be erected by the New York, New Haven & Hartford Railroad Company at Berlin, Ct., has been let to the Berlin Iron Bridge Company, of East Berlin, Ct. This building is 110 feet in width and nearly 200 feet in length, divided into two equal portions, one side to be used for a boiler-room and the other for an engine and dynamo-room. The engine and dynamo-room is provided with a runway and 35-ton traveling crane. The whole framework is to be of steel, the side columns being inclosed by brick walls, and, when complete, it will be one of the most complete, expensive and best central stations in the world, as no pains nor expense have been spared to make it a model.

It is stated that the number of electric railways in Europe was increased last year from 70 to 111, while the total length was raised from about 435 to 560 miles, the number of cars from 1,236 to 1,747, and the horse-power from a little over 18,000 to a little over 25,0 . Of all the European countries, Germany, according to these consular reports, stood at the head, with about 250 miles to her credit and an equipment of 857 cars and 7,194 horse-power.

The other countries follow in this order:

	Miles.	Horse-Power.	Cars.
France	82	4,490	225
England	59	4,243	143
Austria-Hungary	44	1,949	157
Switzerland	29	1,559	86
Italy	25	1,890	84
Spain	18	600	26
Belgium	16	1,120	48
Ireland	8	440	25
Russia	6½	540	32
Servia	6¾	200	11
Norway and Sweden	5	225	15
Roumania	4	140	15
Bosnia	4	75	6
Holland	2	330	14
Portugal	2	110	3

At the annual meeting of the stockholders of the Baltimore Traction Company, the old board of directors was re-elected, as follows: Wm. T. Dixon, Christian Devries, Sydney F. Tyler, James S. Hagerty, Charles Adler, Theodore F. Wilcox, T. Edward Hambleton, Harry A. Parr and William A. House. The annual report of the company shows the gross earnings for the year ended December 31, 1896, amounted to $1,269,514 38, compared with $1,179,191.21 for the preceding year, an increase of $90,323.12, or seven and one-half per cent. The operating expenses were $646,127.79, or 50$\frac{9}{10}$% of the gross receipts, an increase of only $6,421.19, or one per cent over 1895. The fixed charges, which include interest, park tax and general taxes, were $445,-511.05, an increase of $32,413.86 compared with last year. The net increase for the year, over and above all fixed charges and taxes, amounted to $177,875.54, compared with $126,-387.47 for last year, an increase of $51,488.07, or 41 per cent.

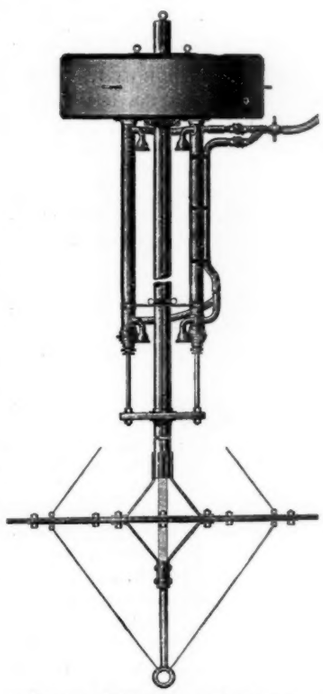
The Fear of the Underground Trolley.

The effect of the adoption by the Metropolitan Traction Company, of New York, of the underground trolley system in this city is likely to be very important in many other large cities where street railway companies are only allowed to use the overhead trolley on sufferance. In many cases the charters of these companies call for the installation of systems dispensing with overhead wires as soon as they have been proved to be practicable. If the underground trolley proves practicable in New York, as is claimed to be the case, there will have to be extensive changes on roads in many cities.—*Wall Street Journal.*

Messrs. F. E. Kinsman and A. A. Knudson have formed a partnership as supervising and consulting engineers, with headquarters in the Manhattan Life Insurance Building, 66 Broadway, New York. They will make expert investigations and report on all classes of electrical enterprises.

A New Invention for the Utilization of Wave Power.

Mr. B. Morley Fletcher, of Westminster, Eng., has for some time past devoted his energies and skill to the long-sought-for solution of the problem of making use of wave power, and his invention, illustrated herewith, would appear to utilize available ample power at a practically nominal cost, and without in any way consuming material other than that arising from the abrasion of the working parts of his most ingenious apparatus. The essence of Mr. Fletcher's invention is the provision of a point of resistance which is fixed in relation to the up-and-down motion



FLETCHER'S METHOD OF UTILIZING WAVE POWER.

of the waves. This is attained by means of a submerged horizontal plane or disk, which is anchored to the sea bottom by powerful and efficient moorings, chains, bridles, etc., due provision being made for the rise and fall of tides. This plate is placed at such a depth below the surface of the water that it is entirely unaffected by the action of the waves. The motor itself consists of two parts; first, a cylindrical tube or hydrometer at right angles to and firmly secured to the upper surface of the plate alluded to, and rising a few feet above the surface of the water, and, second, a cylindrical or other shaped buoy, which floats on the waves around the tube, and which has attached to it a pump barrel, which, in its turn, works round the tube immediately below the buoy. The motion of the barrel is, therefore, synchronous with the movement of the waves, both in a vertical, horizontal or angular position. In other words, the pump barrel moves up and down in the direction of the waves, and the fixed tube provides a piston-rod; *i. e.*, instead of the piston-rod moving in the barrel, the barrel moves up and down the piston-rod. The water pumped can, of course, be conducted by suitable means to the shore, and there used and stored for hydraulic purposes, or it can be conducted on board lightships, piers, harbors, etc., and used for generating mechanical force in connection, for instance, with the generation of electricity for lighting, signaling and other purposes. The illustration shows the experimental apparatus, by means of which the practicability and application of the invention was recently demonstrated in Dover Harbor, this small plant having been prepared and laid down solely for testing purposes.

The results of the exhaustive and continued experiments then made were of a highly satisfactory character, and warrant the further expenditure necessary for the construction and laying down of a much larger and more powerful plant.

In the meantime, apart altogether from its importance as a mechanical factor on land, says London *Industries and Iron*, to which journal we are indebted for our description and illustration, the invention appears most valuable in regard to the safety to be derived from it with respect to navigation round sea coasts, in channels, the entrances to dangerous estuaries and the like during foggy weather, for, by fitting to the plant different apparatus for actuating and sounding fog-horns or sirens, the restless action of the sea would at once enable the navigator to ascertain his true position. A system of varied colored electric lights, flash-lights, etc., might also be devised and fitted on the buoy in a similar manner, and worked continuously or at will, both by night and by day, regardless of the condition of the weather prevailing at the time, thus rendering collisions, strandings and the like less frequent, and reducing the loss of life and property in consequence thereof to a minimum.

THE TELEPHONE AS NURSE AND BED-FELLOW.

HOW THE SUBSCRIBERS OF MOBILE TAKE THEIR MEDICINE—A TELEPHONE WITH EVERY PILLOW.

TO THE EDITOR OF ELECTRICAL REVIEW:

We read with much interest, in your valued paper of February 3, of the night service given by the Johnstown, Pa., Telephone Company.

We think we can go them one better. We have not only been giving all-night service and calling up our subscribers at any time of night, for more than a year, but have acted the part of nurse for our subscribers who have been sick and wanted to take medicine during the night, by calling them as often as once every hour.

Then, again, owing to the convenient construction of our telephone, having the receiver, transmitter and calling device all on one handle, with 10 or more feet of cord, it enables our subscribers to take their 'phone to bed with them, and when they are called, or wish to call central, all they have to do is to reach under their pillow and pull out the 'phone without even getting out of bed. Can there be anything more convenient?

HOME TELEPHONE COMPANY,
A. W. BROOKS, Manager.
Mobile, Ala., February 9.

The United States stands an easy first in power utilization at present, but it is our own fault if our own waste energies do not soon prove to us what water power has proved to the Americans.—*London Electrical Review.*

TELEPHONE NEWS AND COMMENT.

The Electrical Committee of City Councils, of Philadelphia, Pa., have refused to recommend the adoption of a resolution, introduced at the request of the Mayor, requesting the Director of Public Safety to issue permits for the erection of terminal poles by the Bell Telephone Company, in order to utilize the more than 50 miles of conduits it has laid under permits granted by the Department of Public Works. It is alleged the company has no authority from city councils to construct these conduits.

Assemblyman Schneider has introduced a bill at Albany, N. Y., fixing tolls for the use of telephones as follows:

In cities of more than 1,000,000 inhabitants, $7 per month for the first telephone and $5 per month for additional ones; in cities of less than 1,000,000, $4 per month for all telephones. And the rates for long-distance telephones for less than 50 miles, 15 cents for the first five minutes and five cents for every five minutes thereafter; more than 50 miles, 50 cents for the first five minutes and 15 cents for every subsequent five minutes. A penalty of $500 is named for violation of this law in any way, one-half of which is to go to the County Treasurer and the other to the person furnishing the information.

The suit which has been pending in the courts of this State and of New Jersey for over 10 years, between the New York & New Jersey Telephone Company, as plaintiff, against the Metropolitan Telephone and Telegraph Company (now the New York Telephone Company), for breach of a contract, has been finally determined by the Court of Appeals in favor of the plaintiff. The New York & New Jersey company in 1882 obtained from the Metropolitan company, which derived its rights from the Bell Telephone Company, the exclusive use of its telephone rights for a term of years of all the territory in New Jersey except that which had been licensed to a third corporation, called the Domestic Company. The contract with the Domestic Company contained an uncertain provision for the renewal of its term and an alleged oral agreement. The New York & New Jersey company had no knowledge of this oral agreement when it obtained its license from the defendant. It then brought this action to recover of the defendant damages resulting from a loss of the territory by reason of the renewal of the Domestic Company's term of acceptation, and the trial court granted an interlocutory judgment, ordering a reference to ascertain the amount of damages. It was claimed that plaintiff had lost a large share of the benefits of the contract, although it had paid defendant $400,000 of stock and $46,755 in dividends thereon. The Court of Appeals holds, affirming the decision below, Judge Martin giving the opinion, that the plaintiff was entitled to recover.

Plans and specifications for the conduits of the Missouri & Kansas Telephone Company have been approved, and work will be commenced at once in Kansas City, Mo. It is stated that $250,000 will be expended in the enterprise. About 400 men will be put to work as soon as ground is broken, and the work will be pushed to completion.

At the annual meeting of the Newark, N. J., Telephone Company the following directors were elected: John M. Gwinnell, president; George W. Wiedemayer, Samuel Klotz, Osceola Currier, Timothy W. Lord, Theodore C. E. Blanchard and Charles B. Smith, of Newark; Wallace S. Risley, of Camden; G. H. Atkinson and W. H. Chamberlain, of Jersey City; James Russell, of Baltimore, Md., and Lewis M. Simpson, of New York.

Senator Brush, of Brooklyn, N. Y., has introduced in the legislature a telephone bill providing that the Attorney-General, the State Comptroller and the State Engineer shall constitute a commission to investigate all complaints of overcharges for telephone services and to propose remedial legislation.

At the annual meeting of the Boscawen & Canterbury, N. Y., Telephone Company the old board of officers was elected: President, Philip C. Clough; vice-president, James F. French; secretary and treasurer, Laroy A. Glines; directors, Joseph G. Clough, A. H. Brown and Arthur Pickard.

The Citizens' Telephone Company, of Laconia, N. H., recently organized here by local capitalists, have reduced the rates for patrons lower than those of the New England Company, free service with Tilton and Franklin also being offered to regular patrons. The rates offered for usage are $1 for private houses and $1.25 to $1.50 for business places. The capital stock of the company is $5,000, but in case that the Franklin addition should be made, the amount will be increased to $10,000.

The effort to secure a rival telephone system in Denver, Colo., is to be revived in the courts. The attorneys for the Denver Telephone Company have obtained a temporary writ of mandamus to compel the Board of Public Works to permit the Denver Telephone Company to erect poles and string wires. The new company has acquired the franchise of the Rocky Mountain Telephone Company, which was granted some years ago; but, owing to trouble over patent rights, it had to discontinue its service, and now the Denver Telephone Company has acquired the rights of the old company.

General Passenger Agent Scull, of the B. & O. Railroad, recently announced that he had secured the concession from the Joint Traffic Association which makes it possible to give a stop-over in Washington on all first-class tickets sold over the B. & O. through that point. The fight over this concession was quite a bitter one and lasted for a long time, but Mr. Scull finally triumphed.

SAFETY DEVICES FOR ELECTRICAL CIRCUITS.

BY PROF. W. M. STINE, BEFORE THE NORTHWESTERN ELECTRICAL ASSOCIATION, JANUARY 21, 1897.

When an electro-motive force is applied to a circuit and a current results, it is an indication that the circuit possesses continuous conductivity, or is a closed one. We may take any portion of such a circuit and call it a conducting element. Further, we may apply Ohm's law to each element. Knowing the ohmic resistance of any element, and the current intensity in it, the amount of heat it receives is expressed in watts by the numerical product of $C^2 R'$. Under conditions of operation, each and every circuit element is heated and becomes, to a certain extent, a thermal cut-out; it only remains to have the current sufficiently strong to carry its heating to the point of charring insulation or melting the conductor. By a fuse wire we mean, then, a metallic element purposely inserted into the circuit, its size and melting point being so adjusted as to make it the weakest element in the circuit; and, further, its weakness being so carefully adjusted that it shall yield before the other circuit elements are harmed.

This is certainly the rational method of regarding a fuse in circuit, and of obtaining a just estimate of its protective value.

In spite of extended use, the vagaries and uncertainties of the fuse wire became almost a by-word. The manufacturer of fuse blocks, beyond a change of material, wood to porcelain, had shown no satisfactory progress. The fuse wire had been investigated in a few laboratories, but in rather a casual and incomplete manner, and the results were confusing rather than instructive. It was this situation which, some two years since, led the writer to begin a series of exhaustive tests which should look towards formulating precise directions for the use and rating of fuse wires. The details of the processes and the data, amounting to several thousands of determinations, need only be here referred to. The principal points investigated were the time element and uniformity of fusing; the carrying capacity as influenced by length, diameter and inclosure; the effect of use, and the influence of the receptacle. The value of the time element may not be at once apparent. To make the meaning clear, again consider an element of the circuit, such as an armature with relatively small carrying capacity or large $C^2 R$ loss, an insulation which at best is none too effective. So far as the relation of copper and insulation goes, the armature constitutes a fusible element, and against this is to be opposed a thermal protection. Let a sudden powerful rush of current occur, both the armature and fuse wire suffer relatively large increase of heat, due to the $C^2 R$ losses in them. It is then only a question which shall let go the sooner. In general, the protective device should let go at once. An objection may be offered just here—in motor service a large onrush of current occurs when the motor is thrown into service. It is granted that this is just what does occur; but the question is here raised, Should it occur? So far as this is concerned, a motor should have as strong starting torque as possible, and, wherever possible, should be started up under a light load. Further, the starting resistance should be so proportional that the motor in starting shall take no more than normal running current.

To show the effect of the open and closed fuse blocks, a five-ampere round fuse wire was timed to blow in just one minute. In the covered block it carried 20 amperes for this time, with a distance between the contracts of one-half inch. In an open block, when the distance was seven-eighths of an inch, the critical current was 15 amperes. To illustrate the effect of the length of the fuse on its blowing time, and as well to show the supposed accuracy of the maker's rating, an eight-inch length fused in one minute with nine amperes. This has been selected as a fairly typical case from amongst a mass of data.

To show the influence of the time element, a few tests may be cited. A three-ampere wire carried 35 amperes for nearly one second, and a 10-ampere wire, 65 amperes for the same time, and this, too, with the wires under the most favorable conditions, having a fusing length of eight inches. One may well ask the effect with the lengths ordinarily employed. Our tests showed the currents carried are several times as large.

One of the most instructive curves which we platted from our tests was a set showing the influence of the length of the fuse upon its carrying capacity. These curves showed that after a certain length was exceeded, which depended upon the size of the wire, they fused uniformly with the same current. As an example, a 16-ampere wire one inch in length fused at 28 amperes, two inches at 18 amperes, three inches at 17 amperes, four inches and over at 16 amperes. This definitely shows that this particular wire, if used on its rating of 16 amperes, should not be employed in lengths less than four inches; but if it is desirable to use it in a shorter length, the curve will indicate its capacity for such length. It would be an excellent plan for manufacturers to send out such calibration curves with their products.

In order to give the foregoing remarks a more tangible form, certain practical conclusions, which we have already published in the proceedings of the American Institute of Electrical Engineers for 1895 and elsewhere, may bear repeating:

1. Covered fuses are more sensitive and have a lower carrying capacity than exposed ones.
2. Fuse wire should be rated for its varying capacity for the lengths ordinarily employed.
3. Fuse blocks should be made with greater distances between the terminals.
4. Fuses should be removed from time to time, as they become coated or fouled.
5. The time element should be considered when protecting parts liable to burn out.
6. Fuses up to five amperes should be at least one and one-half inch in length; one-half inch to be added to the length for each increment of five amperes.
7. Except for smaller sizes, flat fuses are more reliable than round wires.
8. Round fuse wire should not be employed in excess of 30 amperes capacity. For higher currents flat ribbon exceeding four inches in length should be employed.

This subject can not be dismissed without pointing out the duty of the manufacturer. The ordinary method of marking fuse wire is entirely inadequate. Each spool of wire should be accompanied by a curve or table clearly setting forth the carrying capacity for varying lengths. Better still, the use of wire should be discontinued, and fuses sold already mounted to copper terminals, plainly marked with their normal rating, which should be at least 80 or 90 per cent of their fusing currents.

There is one form of mounted fuse almost universally used which is highly objectionable, even though used only on small tap circuits. The screw fuse plug is here referred to. Not only is the length of wire too short, but poor workmanship and liberal use of solder raises their fusing points to a dangerous degree. As a rule, their actual fusing points are double their marked ratings.

Professor Stine concluded with a review of mechanical cut-outs and their operation, and was warmly thanked by the association for his valuable paper.

THE INCLOSED ARC LIGHT.

DELIVERED BEFORE THE SOCIETÉ INTERNATIONALE DES ELECTRICIANS, PARIS, FRANCE, JANUARY 20, 1897, BY L. B. MARKS, M. M. E., OF NEW YORK CITY.

(Continued from page 69.)

The heated gases are diverted in their course, and, instead of passing freely out of the inclosure, tend to fill the bulb with a deoxygenated atmosphere, thus illustrating the action of the gas-check plug of the inclosed arc lamp.

Table of life tests with and, without gas-checking attachment—carbons, 11.11 millimetres in diameter:

Remarks.	No Gas-check.	Gas-check.	No Gas-check.	Gas-check.
Total consumption of carbon per hour. (In millimetres.)	2.656	1.331	3.175	1.085
Consumption of (—) carbon per hour. (In millimetres.)	.538	(—).152	.424	(—).076
Consumption of (+) carbon per hour. (In millimetres.)	2.118	1.483	2.751	1.161
Mean energy. (Watts.)	509.65	506.56	496.12	511.81
Mean arc tension. (Volts.)	63.86	68.4	61.77	63.5
Mean current. (Amperes.)	7.98	7.90	8.03	8.06

LIFE TESTS.

1. With and without gas-checking attachment: The use of the gas-check plug makes it possible to prolong the life of the carbons far beyond that which can be reached without employing this device. In the table before you I give the results of tests made with and without the gas-checking attachment, other conditions being practically the same. You will note that in one of the tests the total consumption of carbon with the gas-check plug was only a trifle over one-half, and in the other a shade more than one-third of that resulting from the omission of the gas-checking attachment. The prolongation in the life of the negative electrode was exceedingly marked, the latter having increased in length in each case when the gas-checking attachment was used.

2. With carbons 11.11 millimetres in diameter in five-ampere lamp: A pair of carbons which in the ordinary open arc will burn from six to eight hours, will last from 100 to 150 hours in commercial practice in the high-potential inclosed lamp which I have already described to you. A life test of a pair of carbons 11.11 millimetres in diameter, operated in the standard lamp, is given below. This is a report on the performance of a lamp which is in service about four hours every day. The total run was 121 hours.

3. With carbons 12.7 millimetres in diameter in four-ampere lamp: When the diameter of the carbons is increased, the longevity is greater, but other objections are introduced which will be treated of under the heading of "Efficiency of the Inclosed Arc." The life test of a pair of carbons 12.7 millimetres in diameter, running about 12 hours per day in a four ampere lamp, is appended:

TABLE.

Life test of carbons 11.11 millimetres in diameter in "Pioneer" five-ampere inclosed arc lamp:

Original length (+) carbon	=	306.387 mms.
" " (—) "	=	121.10 "
Final " (+) "	=	109.587 "
" " (—) "	=	82.55 "
Total run	=	121 hours.
Consumption (+) carbon per hour	=	1.652 mms.
Consumption (—) carbon per hour	=	319 mms.
Maximum current	=	5.25 amps.
Minimum "	=	4.65 "
Average "	=	4.98 "

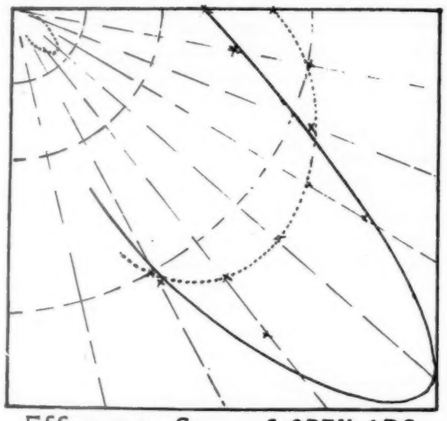
TABLE.

Life test of carbons 12.7 millimetres in diameter in "Pioneer" four-ampere inclosed arc lamp.

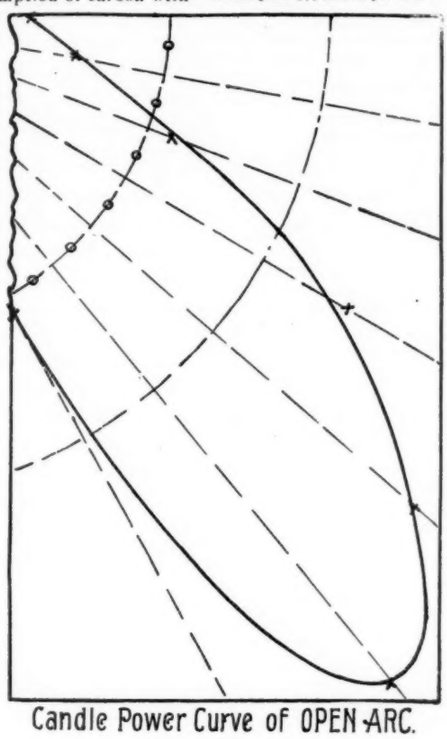
Original length (+) carbon	=	304.80 mms.
" " (—) "	=	128.587 "
Final " (+) "	=	114.30 "
" " (—) "	=	77.787 "
Total run	=	199 hours.
Consumption (+) carbon per hour	=	.957 mms.
(—) " " "	=	.395 "
Maximum current	=	4.5 amps.
Minimum "	=	3.8 "
Average "	=	4.15 "

EFFICIENCY OF THE INCLOSED ARC.

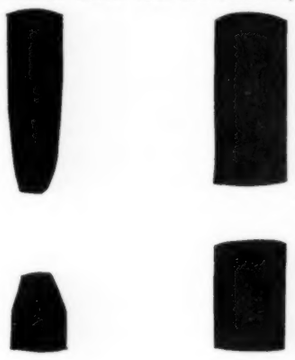
On a previous occasion I published some curves showing the relative radiant efficiency of the inclosed arc, one of which curves I will reproduce here for you in contrast with an efficiency curve of an average open arc. Referring to the figures, the dotted line curves indicate the relative luminous and total radiation, respectively. The ratio of the luminous to the total radiation of the lamp at various angles below the horizontal is given in the heavy line curve, which therefore represents the radiant efficiency of the arc. In the case of the inclosed arc the measurements are given for a clear glass inclosure; in the case of the open arc the readings are given for the naked arc, no globe having been used. The mean hemispherical efficiency of the inclosed arc was found to be 8.4 per cent; that of the open arc for the same current, 11.7 per cent. It will be noted that the efficiency curve of the inclosed arc differs materially from that of the open arc, the distribution of light in the former being more uniform than that of the latter. In the inclosed arc the change in efficiency from 20 to 60 degrees is inconsiderable, while in the open arc the change is decidedly marked, the curve taking a very sharp turn at about 40 degrees.



Efficiency Curve of OPEN ARC.

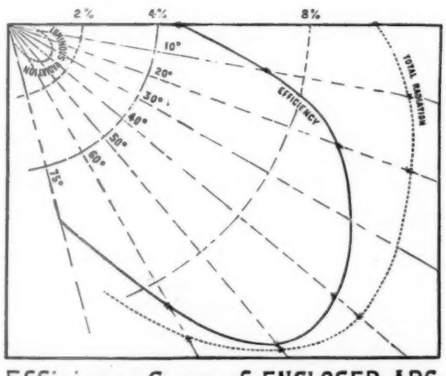


Candle Power Curve of OPEN ARC.

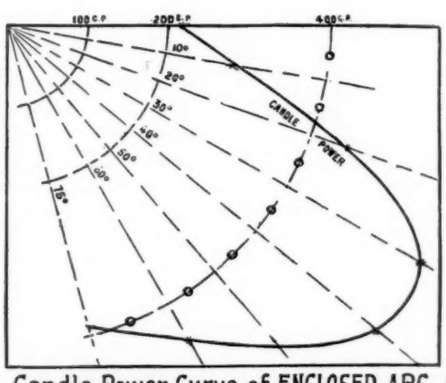


Open ARC 6 Ampères; 85 Volts.

Enclosed ARC 6 Ampères; 85



Efficiency Curve of ENCLOSED ARC.



Candle Power Curve of ENCLOSED ARC.

Open ARC 6 Ampères; 45 Volts.

Enclosed ARC 6 Ampères; 45 Volts.

The figure which I have given for the efficiency of the naked arc is much higher than that of the average naked arc in service in the United States. From tests which I have made, it is safe to say that, as commercially operated, the average efficiency of the open arc lamps falls considerably below 10 per cent, without deducting the loss due to the interposition of a clear or translucent glass globe. When we consider the case of an open indoor lamp with an opal globe, such as used extensively in this country, and compare the same with that of an inclosed arc lamp as commercially operated, the relative radiant efficiency measurements as given above do not represent the true relative illuminating powers in the two cases. With the open arc for indoor illumination, it is necessary to soften the light; in other words, to enlarge the area of the source of illumination. With the common opal globe, it is found in practice that from 40 to 60 per cent or more of the light is necessarily cut out in obtaining the requisite distribution just alluded to. With the inclosed arc, on the other hand, where a thin outer globe is used, this distribution can be obtained with a loss of not more than one-half of

(Concluded on page 80.)

Electrical Review

Times Building, 41 Park Row,

P. O. Box 2339. **NEW YORK.**

EDITOR:
CHARLES W. PRICE.

ASSOCIATE EDITOR:
STEPHEN L. COLES.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

1846 "CORTLANDT," TELEPHONE CALL.

Subscription to the
ELECTRICAL REVIEW.

One Year, United States and Canada, -	$3.00
One Year, Foreign Countries, - -	5.00
Single Copy, - - - - - - -	.10

Copies can only be supplied for one year back at 25 cents each.

Special Notice to Advertisers.

***CHANGES** for advertisements must be in this office by Friday noon for the following week's issue.*

***NEW ADVERTISEMENTS** should be in the office not later than Saturday noon to insure publication the following week.*

NEW YORK, FEB. 17, 1897.

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It is announced that one Judge Perry, of Lexington, Ky., has raised $1,000,000 to manufacture a new air-motor. This is a pretty fair-sized investment in wind.

We were a little disappointed at the recent gas exhibition, in the absence of novelties expected to be on view. Artistically, it was a most striking scene, the admirable blending of the useful and the beautiful. Not the least important of the smaller exhibits were a couple of burner tips of the anti-blow-out type. They were a success, and hotel proprietors might do worse than adopt them in all bedrooms.

Edison was 50 years old on Thursday of last week, February 11. He celebrated the day by working at his iron mines in New Jersey, rejoicing over the success, now in sight, of his magnetic ore-separating plans that have cost so many hundreds of thousands in money and years of closest labor. His health is very good, his energy and vitality as abundant and inexhaustible as ever, and his wonderful, searching eyes as bright and penetrating as in those early days in the seventies when his first discoveries began to attract the attention of the world. That great mane of hair is gradually whitening, however.

The interest in electric protection of safes from the unauthorized visitor at unusual hours is of considerable extent. Our recent articles have brought out inquiries from safe manufacturers and detectives, and we expect any day to receive the opinion of genuine safe cracksmen. All will be treated impartially, and at an early day our burglar editor (as soon as we can visit him again) will no doubt have some additional information for the public.

INCANDESCENT LAMPS.

To know what are the economies in incandescent lamps has been a question which perhaps has been the subject of more discussion by central station managers than any other point. Even to this day the facts are not so thoroughly understood that opinion has developed into settled conclusions as to the moment when it becomes expedient to substitute for an old lamp, which may not be absolutely dead, a new one, and whether it is expedient to buy low or high-priced lamps. These are all questions which are susceptible of being reduced to figures and facts, and thereby reaching an accurate result.

At the meeting of the Northwestern Electrical Association at Milwaukee, on January 20, Mr. Franklin S. Terry read a most opportune paper, which is worthy of consideration, because it has quite definite explanations of many of these points, which, while they may be known, are not always properly weighed by the central station manager and the electrical engineer.

THE ENERGY OF THE TIDES.

Perennial is the scheme for the utilization of tidal energy. The latest is a case mentioned in *Invention*, where the writer actually operated 10 incandescent lamps, only requiring a few accessories, such as two reservoirs for impounding the water at high tide, a bifurcated race, a couple of turbine wheels, a dynamo and the requisite gearing. There is money to burn after all the hard times.

Undoubtedly there is a vast amount of energy in the tidal movements, but it may be questioned if it can fairly be called a waste energy. Suppose here, in our vicinity, some enterprising individual were to publish a prospectus showing how he intended to corral the tides in East River, and, with the energy thus filched, illuminate the city. Take away the energy of the tidal movements, and what becomes of the thousand uses to which the tides now lend a utilitarian hand? Any large scheme of the kind would be opposed from all directions, and any small plant, not affecting the public, would not pay interest on its cost, except, perhaps, in some localities especially suited to the purpose. In such places, by all means, let the inventor spread himself and the light of progress as well.

BOOK NOTICES.

"ELECTRIC TRAMWAYS AND RAILWAYS POPULARLY EXPLAINED," by H. Scholey. H. Alabaster, Gatehouse & Company, London.

The book presents briefly the latest developments of electric traction, with sufficient historical reference. It is written in popular style and is well illustrated.

"AUTO-CARS," by D. Farman. Whittaker & Company, London; the MacMillan Company, New York. Price, $1.50.

This is translated from the French, and is a comprehensive work on horseless carriages. It is well illustrated, gives the history of art to the latest inventions at the end of 1896. It is an excellent book for the earnest workers in this field. It is supplied by this office.

"POWER DISTRIBUTION FOR ELECTRIC RAILROADS," by Dr. Louis Bell. Street Railway Publishing Company. Price, $2.50.

Dr. Bell is recognized as one of the ablest writers on electrical topics. His statements are clear. He combines technical and practical knowledge in a highly interesting and instructive way in his latest publication named above. It is a valuable, modern and comprehensive book, and should be in the library of every up-to-date electric railway man.

The decision of the New York court, in the case of the New York & New Jersey Telephone Company vs. the Metropolitan Telephone Company will necessitate president Chas. F. Cutler, of the latter company, settling with president Chas. F. Cutler, of the former company.

THE TELEPHONE SITUATION.

PAPER READ BEFORE THE CHICAGO ELECTRICAL ASSOCIATION, FEBRUARY 5, 1897, BY W. CLYDE JONES.

To understand the present situation, it will be necessary to consider briefly the evolution of the telephone transmitter. In 1854 Charles Bourseul said:

I have asked myself if the spoken word itself could not be transmitted by electricity; in a word, if what was spoken in Vienna may not be heard in Paris. The thing is practicable in this way: Suppose that a man speaks near a movable disk sufficiently flexible to lose none of the vibrations of the voice; that this disk alternately makes and breaks the connection with a battery; you may have at a distance another disk which will simultaneously execute the same vibrations.

Bourseul thus stated a proposition which Philip Reis sought to solve, but he followed Bourseul's suggestion too closely to realize the transmission of speech, though he successfully transmitted musical sounds. He employed as a transmitter a diaphragm, which, in its vibration, opened and closed an electric circuit, thus sending impulses over the line to a receiver, comprising an electro-magnet opposite, the pole of which vibrated an armature mounted upon a pivoted plate, which, in beating the air, reproduced the sound. Since his transmitter opened the circuit in vibrating, Reis was unable to transmit speech.

Bell conceived, as a mathematical proposition, that, in order to transmit speech, the circuit must not be broken to send impulses over the line, but that the current must be caused to undulate in exact accordance with the undulations to and fro of the air particles in constituting the sound. His mathematical theory was proven to be correct, and the speaking telephone was an established fact. A patent was granted to Bell, broadly covering the method of transmitting speech by an undulatory current, March 7, 1876, No. 174,465. Bell described in his patent a number of ways of producing the undulatory current. He says:

Undulations are caused in a continuous voltaic current by the vibration or motion of bodies capable of inductive action; or by the vibration of the conducting wire itself, in the neighborhood of such bodies. Electrical undulations may also be caused by alternately increasing and diminishing the resistance of the circuit, or by alternately increasing and diminishing the power of the battery. The internal resistance of the battery is diminished by bringing the voltaic elements nearer together, and increased by placing them further apart. The reciprocal vibrations of the elements of a battery, therefore, occasion an undulatory action in the voltaic current. The external resistance may also be varied. For instance, let mercury or some other liquid form part of a voltaic circuit, then the more deeply the conducting wire is immersed in the mercury or other liquid, the less resistance does the liquid offer to the passage of the current. Hence the vibration of the conducting wire in mercury or other liquid included in the circuit occasions undulations in the current. The vertical vibrations of the elements of a battery in the liquid in which they are immersed produced an undulatory action in the current by alternately increasing and diminishing the power of the battery.

Elisha Gray, who independently discovered the requisite undulatory current necessary for the transmission of speech, employed a vessel containing acidulated water, into which dipped a needle carried on the diaphragm, the needle and the liquid being included in the circuit, and the variable immersion of the needle, due to the vibration of the diaphragm, causing a variation of the resistance of the circuit by varying the surface of the needle in contact with the liquid. Bell, in practicing his invention, had employed a vessel containing mercury, into which dipped a cone-shaped electrode vibrated by the diaphragm varying the extent of the surface of the cone in contact with the mercury, and thus varying the resistance of the circuit, in which were included the cone and the body of mercury. The variation of resistance was thus due to the variation of the surface of contact between two electrodes, one of which was solid and the other liquid.

It was at this stage of the art that Berliner appeared, and in a caveat filed in the Patent Office, April 14, 1877, showed a telephone in which two solid electrodes were employed in constant contact. One of the electrodes was vibrated by the diaphragm to vary the surface of contact between the two electrodes. Subsequently to the filing of the caveat, on June 4, 1877, Berliner filed an application for a patent on a telephone in which a diaphragm forming one terminal of the circuit was adapted to vibrate between two contacts, one situated upon the front and the other upon the rear of the diaphragm, the contacts being connected with the opposite terminal of the circuit. The fact that Berliner thus filed an application on a make-and-break telephone incapable of transmitting speech, after having shown in his caveat a constant-contact transmitter, is alleged to show that he had not received successful results in the operation of the transmitter of the caveat, and had abandoned it for the double-contact transmitter. The application was afterward amended to show and claim the constant-contact feature, and upon this application the Berliner patent of October 29, 1891, was granted.

About the time of the Berliner experiments, Edison was developing his carbon transmitter, and subsequently to the filing of the Berliner application a description of his invention was published on July 9, 1877, in the Philadelphia *Press*, and as it was after this, on August 8, 1877, that the amendment was made to the Berliner application, erasing the double-contact feature and substituting the constant-contact feature, it is claimed that the amendment was made to embody Edison's invention, and this is one of the grounds on which the patent is attacked. The Patent Office, however, held that Berliner was entitled to the idea of two electrodes in constant contact, while Edison was awarded broadly the feature of employing carbon as an electrode. Edison's patents on this feature were granted in 1892, but as foreign patents had previously expired, and as United States patents, previously patented in a foreign country, expire with the first expiring foreign patent, the Edison patents had technically expired before they were granted, if such an anomalous state of existence can be imagined.

Subsequently a patent was granted to Hunnings for a telephone in which granular carbon was employed. This patent has already expired with a foreign patent for the same invention.

Thus, the only controlling patent on the transmitter which has not expired is the Berliner patent, the claims of which are as follows, and on their face cover all forms of variable pressure transmitters:

1. The method of producing in a circuit electrical undulations similar in form to sound waves, by causing the sound waves to vary the pressure between electrodes in constant contact so as to strengthen and weaken the contact, and thereby increase and decrease the resistance of the circuit, substantially as described.

2. An electric speaking telephone transmitter, operated by sound waves and consisting of a plate sensitive to said sound waves, electrodes in constant contact with each other, and forming a part of a circuit which includes a battery or other source of electric energy, and adapted to increase or decrease the resistance of the electric circuit by the variation in pressure between them, caused by the vibrational movement of said sensitive plate.

By reference to the above quotation from the Bell patent, it will be observed that means are described for producing an undulatory current by varying the electro-motive force of the current, and means are also described for varying the resistance of the circuit; the internal resistance of a battery by raising and lowering the plates, or by moving them toward and from each other, and the external resistance by varying the resistance between electrodes in constant contact. As employed by Bell and by Gray, one of the electrodes had been solid and the other liquid, the variable pressure produced by the diaphragm resulting in varying the surface contact of the electrodes and also varying the length of the path through the liquid. The cone electrode of Bell operated solely upon the variation of the surface contact between the solid electrode and the mercury electrode.

The step which Berliner took was to replace the mercury electrode of Bell by a solid electrode. In this case, as in that of Bell's transmitter, the variable pressure produced by the vibration of the diaphragm varied the extent of the surfaces of the two electrodes in contact, and thereby varied the resistance, the greater the movement of the diaphragm, the greater being the size of the surface of contact. Edison and Hunnings also employed solid electrodes, Edison employing carbon electrode in contact with a second electrode of carbon, platinum or other material, while Hunnings employed a plurality of electrodes of carbon in the form of small granules, the extent of the contact surfaces between which was varied by the vibration of the diaphragm.

The following is a tabulation of the different ways in which it had been proposed to produce undulatory currents at this time:

1. By varying the electro-motive force.
   (a.) By magnetic induction.
2. By varying the resistance.
   (a.) By varying the internal resistance.
      (1.) Distance between plates.
      (2.) Area of plates.
   (b.) By varying external resistance.
      (1.) One liquid and one solid electrode.
         (a). Amount of liquid in circuit.
         (b.) Amount of surface of electrodes in contact.
      (2.) Two solid electrodes.
         (a.) Amount of surface of electrodes in contact.

It will be observed that all of these different ways of producing the undulatory current were suggested by Bell in his patent except the last, that of varying the amount of surface of *solid* electrodes in contact.

[To be concluded.]

X-Ray Apparatus.

TO THE EDITOR OF ELECTRICAL REVIEW:

I am very much interested in your record of electrical progress, especially the articles appearing from time to time from the pen of Nikola Tesla on high-potential currents and Roentgen rays.

Regarding the article now appearing in your columns written by Mr. Willyoung, I have a Tesla coil which I have made for my own use which has none of the disadvantages which he says such coils must necessarily have. As to time of exposure, I have obtained good negatives through thorax in two minutes, and never expose same more than five minutes. I take hand distance of tube same as in the article in two seconds.

The article states that an extremely high vacuum is necessary for work through the body. I worked on this line some time with poor results, as my rays penetrated bone and all, turning plate black all over. I observed cause, reduced vacuum, and am now obtaining uniformly excellent results. This is the first mistake I have observed in your exceptionally exact columns, and it indicates that your author has not experimented with the most powerful exciting apparatus.

B. P. REMY.

Anderson, Ind., February 11.

American Institute of Electrical Engineers.

The 112th meeting of the Institute will be held at 12 West Thirty-first street, New York city, on Wednesday, February 17, 1897, at 8 o'clock P. M. A paper will be presented by Mr. John W. Howell entitled, "The Conductivity of Incandescent Carbon Filaments and of the Space Surrounding Them."

PERSONAL.

Mr. Henry B. Cram, of Boston, is visiting New York city, and is making his headquarters at the Murray Hill Hotel.

Mr. J. H. Reid, general sales agent for the Westinghouse Glass Factory, Pittsburgh, is making a trip through the West.

Mr. D. Hemingray, of Covington, Ky., was a recent visitor in New York at the Holland House. The celebrated glass insulators of his company are very popular with all users.

The personal estate of the late Joseph B. McCullagh, the veteran St. Louis editor, is valued at nearly $900,000. He also owned large amounts of stocks, including $5,000 worth in the Edison Electric Illuminating Company of St. Louis.

Col. Henry C. Davis, former president of the Sawyer-Man Electric Club, was a guest of Mr. Marshall T. Davidson at the recent Lincoln dinner at the Union League Club in Brooklyn. Col. Davis is now engaged in railroading and coal mining, with headquarters in Philadelphia.

The following out-of-town visitors registered at the headquarters of the National Electric Light Association, 136 Liberty street, New York, during last week: S. G. Booker, St. Louis, Mo.; Jas. I. Ayer, Boston, Mass.; F. S. Terry, Chicago, Ill.; W. C. Bryant, Bridgeport, Ct.; F. Z. McGuire, London, Eng.; T. H. Brady, New Britain, Ct.; F. A. Gilbert, Boston, Mass.; E. B. Hatch, Hartford, Ct.; J. H. Rhotehamel, St. Louis, Mo.

William Taylor Goes Around the World.

Mr. William Taylor, formerly of Taylor, Dee & Mack, electrical dealers, of Chicago, now of New York, was successful in guessing the nearest to McKinley's plurality, and, therefore, receives the prize of a trip around the world at the expense of the *Evening Telegram*, of New York. Mr. Taylor's guess was 597,397, which was within eight votes of the exact plurality.

KIND WORDS.

RECOMMENDS IT.

TO THE EDITOR OF ELECTRICAL REVIEW:

I can recommend the ELECTRICAL REVIEW as the very best paper in its line published.

Very truly yours,

February 12. F. L. STUART.

READ WITH GREAT INTEREST.

TO THE EDITOR OF ELECTRICAL REVIEW:

We inclose you herewith check for renewal of our subscription. We always receive your paper with a great deal of interest.

The Warren Electric and Specialty Co.

E. W. GILLUM, Secretary.

Warren, Ohio, February 12.

The use of the Brooklyn Bridge by the elevated and trolley lines, of New York and Brooklyn, means, we believe, the adoption of electric power on the elevated railroads of both cities. Hasten the day.

THE INCLOSED ARC LAMP.

(*Continued from page 77.*)

that in the case of the open arc, especially when the inner bulb of the inclosed arc is made of a slightly translucent glass.

The conservation of heat in the inclosed arc makes it possible to operate a carbon of given diameter at a relatively higher efficiency than in the open arc. Thus a carbon 11 millimetres in diameter, operated in the inclosed arc lamp at a current of from four to five amperes, will give about the same efficiency, relatively, as a carbon eight millimetres in diameter operated at the same current in an open lamp. This makes it possible to use a carbon of large diameter more efficiently in the inclosed lamp than in the open lamp. It is found, however, that with these small currents it is expedient, for several reasons, to use carbons appreciably larger in diameter than the size quoted above.

Firstly, with the larger carbons the radiation is more rapid and the temperature is decreased; the efficiency, being a function of the temperature, is therefore also decreased.

Secondly, the amount of light cut off by the carbons themselves when the latter are large in diameter becomes considerable. This applies especially to the rays cut off by the flattened tip of the negative carbon.

Thirdly, the coating of the internal surface of the inclosure cuts off light in proportion to the thickness of the deposit. It is well known that all carbons contain a small percentage of impurity, consisting chiefly of silica. When the carbons are consumed in the open arc, this silica passes off into the atmosphere. When the carbons are consumed in the inclosed arc, the impurity settles in the form of a thin coating on the internal surface of the inclosure. Although the amount of this deposit is very slight when the carbons are burned only for a short time, the amount of light cut off becomes appreciable when the coating thickens. It has been found in commercial operation in the United States that after 100 hours' burning the decrease in the illuminating power of the lamp, due to the formation of this coating, is not noticeable by the consumer; after about 150 hours, however, the decrease in illumination becomes objectionable, and it is necessary to wipe out the inclosing bulb. Now, with a pair of carbons 12.7 millimeters in diameter, the life, as shown in the test which I have cited for you, is about 200 hours. As a result of this long burning, the light efficiency is cut down to an objectionable extent; hence in this case we are using a large carbon at the sacrifice of efficiency from all three standpoints mentioned above.

In the candle-power curves which I have given here for comparative purposes, the same difference in distribution of light will be noticed as in the case of the efficiency measurements. The mean hemispherical candle-power of the inclosed arc, as determined from the curve, is 431, the watts per candle being 1.17. The corresponding values for the open arc are .425 and .953. In the case of the inclosed arc the maximum candle-power, as may be deduced from the curve, is 595, while the corresponding candle-power of the open arc is 1,080. The figures for the open arc are taken for a brand of carbon in extensive commercial use in the United States. In the candle-power curve for the open arc the readings begin at 200 instead of 0.

It will be noted that, although the maximum candle-power of the open arc is almost twice that of the inclosed arc, the mean hemispherical candle-power of the former is a trifle less than that of the latter. In general it will be found that because of the comparatively deep crater in the positive carbon of the open arc, the difference between the maximum candle-power and the mean candle-power is very great; in the inclosed arc, on the other hand, especially when the bulb is made of a slightly translucent glass, this difference is very slight.

A comparative test of candle-power of the open and inclosed arc lamps, respectively, was made here recently by one of the illuminating companies, and I submit the report of same to you. The candle-power measurements represent the relative illumination produced in actual practice. The open lamp was provided with the usual opal globe in common service here, and the inclosed lamp with an opalescent inner and a thin opal outer globe, such as used in the standard inclosed arcs. For the same wattage the excess of candle-power was slightly in favor of the inclosed arc lamp.

It is difficult, if not impossible, to obtain a true value of the effective illumination of an arc lamp, especially of the inclosed arc, in terms of candle-power. In interpreting the candle-power tests of arc lamps, this fact must be taken into consideration. The quality of the light emitted by the inclosed arc differs from that of the open arc, and on this account comparative candle-power measurements must always be lacking, more or less, in truly representing the relative values of the lights. I have found, in some cases, that an inclosed arc, although producing actually less candle-power than an open arc, has given more *available* illumination, and on this account met the demands of the consumer better than did the open arc. The number of open arc lamps which are daily being displaced by inclosed arcs in the city of New York alone is the best evidence in proof of the fact which I have cited.

TABLE.

Candle-power test, "Pioneer" four-ampere inclosed arc, and "Ward" eight-ampere open arc:

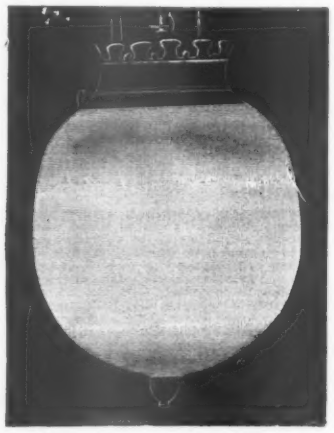
Mean watts arc, inclosed lamp	= 349	
Mean watts arc, open lamp	= 346	
Excess of watts, inclosed arc	= 1	per ct.
Excess of candle-power, inclosed arc	= 2¼	"

FLUSH OF CURRENT.

The amount of current consumed at start by open lamps run two in series on incandescent circuits is generally excessive compared with the normal current passed by the lamp. The amount of current consumed by such lamps, just after the latter have fed, often rises to a comparatively excessive point; this latter is true, especially, of lamps the mechanism of which has been clogged with dust or grit in the ordinary course of commercial usage. In the inclosed lamp, which you have before you, on the other hand, the inrush of current—that is, the starting current—is practically as small as the normal current of the lamp; there is no excess of current after feeding, as in the other case.

GRAPHITIC NIB on side of Carbon Negative. Metallic Negative With Graphitic Carbon Nib.

Cut of Pioneer Globe showing absence of shadows, and perfect distribution of light in the new system; (from actual photograph of illuminated globe).



Cut showing shadows on Globe of Arc Lamp of the Old System; (from actual photograph of illuminated globe).

Measurements made on an average pair of commercial open lamps are given below and will illustrate the above points. It will be noted, from this table, that the starting current of the lamps was 25 amperes; at the end of three minutes the current had fallen to 16 amperes, but then jumped up again to 21; the normal current was reached after five and one-half minutes, the feed having taken place at seven minutes after start. Thus, in this case, the starting current was 150 per cent, and the current after feed, 20 per cent greater than normal. With many pairs of open lamps in commercial service, the current after feed is often from 50 to 100 per cent greater than normal. With the inclosed lamp the inrush of current does not exceed the average by more than 20 per cent, and the current after feed seldom rises over 10 per cent more than normal.

TABLE.

Flush of current in open arc lamp; rated current = 10 amperes.

Time (minutes)	Current (amperes)
0.	25.
1.	20.5
2.	19.
2.5	16.8
3.	16.
3.25	21.
3.5	14.
4.	12.
4.5	12.
5.	11.
5.5	11.
6.	10.
6.5	10.
7.	12.
7.5	11.

FORMATION OF THE CARBON POINTS AND "BUILDING" OF THE NEGATIVE; OBSERVATIONS OF THE ARC.

You are all familiar with the typical formation of the carbon points of an arc in open air. When the arc is inclosed in a small bulb, however, from which the air is excluded, or to which it has very limited access, the carbon points take an entirely different form, even though the current and voltage of the arc be the same in both cases. Here are two pairs of carbon tips which have been operated under the same conditions, except as to the inclosure. I have also presented photographs of these. The carbons were burned at six amperes in each case, the drop across the arc being maintained at 45 volts. You will note that when the carbons are burned in open air, the negative is well pointed, while the positive tapers at the tip and has a well formed crater. Contrasting this formation with that of the inclosed arc carbon points, you will note that the positive in the latter case has a blunt and almost square tip, and the negative, instead of being pointed, has a "mushroom" formation at its tip. The inclosed arc at the voltage cited was 1.7 millimetres long, and the open arc almost 3.5 millimetres long between the tip of the negative and the center of the crater in the positive.

When the voltage of the arc is increased, the carbon points assume a different shape. I give a photograph of carbons of the same quality and diameter as the last; these carbons were burned at the same current; viz., six amperes, but in each case the voltage was raised from 45 to 85. You will note that the formation of the carbon points in open air at 85 volts is entirely different than at the lower voltage; the positive carbon is eaten away for a greater part of its length, and has no perceptible crater; the negative carbon, instead of being pointed, is rounded off at the tip. In this case the arc was about 15 millimetres long and "flamed" continuously. The formation of the points in the inclosed arc under the same conditions as to current and voltage is in striking contrast to that of the open arc. You will observe that the points are flattened, and are, indeed, almost square; the positive and the

negative tips, respectively, have almost the same shape; the arc in this case was nine millimetres long. The "mushroom" deposit or nib on the negative carbon, which has been referred to several times, consists of graphitic carbon, which is deposited electrolytically on the lower carbon by the action of the arc. The deposit of this carbon is in no sense due to gravity, as the same formation takes place if the current is reversed, in which case the graphitic bead forms on the upper carbon. When carbons are operated in the inclosed arc at the same voltage as is ordinarily used in an open arc, this nib will always form on the negative, provided the access of oxygen to the inclosure is very limited. When the voltage is raised to a sufficient degree, however, this nib is eaten away or its formation entirely prevented; in the last case the carbon particles from the positive, while in transit to the negative, are combined with oxygen to form CO_2 and CO gases. The point at which the electrolytic deposit ceases to be fixed depends upon the current passing, the voltage of the arc, the amount of free oxygen present and other conditions. The voltage of the arc in the high-potential, low-current inclosed lamp is from 80 to 85, but even when this voltage is decreased to 70, as occurs sometimes on account of fluctuations on the circuit, the graphitic formation does not take place at small currents; when the voltage falls appreciably below this point, the nib may make its appearance on the negative.

The attempt to utilize this principle to secure an indestructible negative has already been alluded to in the case of the metallic negative with the carbon nib, photograph of which is given herewith. In all cases where such negatives were used, it was, of course, necessary to operate at a low voltage in order to preserve the deposit intact. At this low voltage the arc is very short and frequently unsteady. Moreover, the difficulty of adjusting lamps to meet the conditions required is very great. Aside from other disadvantages, there is always a deposit of uncombined carbon on the walls of the inclosure when a lamp is operated at low voltage in this manner. The "building" of the negative becomes quite marked in some cases where a more powerful current is passed. I have known an instance where the negative actually increased about two inches in length during a run of 11 hours, the mean current being 10½ amperes and the mean tension of the arc 50 volts.

Reference has already been made to the cutting off of light by the carbon points in the case of short arcs. When cored carbons are used as positives, which is generally the case in open arc lamps operated on incandescent circuits, the crater in the upper carbon assumes a distinctly concave formation; the walls of the crater thus cut off a large percentage of light at and slightly below the horizontal, and the interposition of the negative carbon in such cases also decreases the angle, sub-tending the zone of most powerful illumination. The shadows thus thrown by the upper and lower carbon points, respectively, are distinctly discernible on the globe of the lamp. With the inclosed long-hour arc lamp, in which the carbons are separated from four to six times as much as in the case just alluded to, the concavity of the crater in the upper carbon is inappreciable, and the light is not intercepted by the side walls, nor cut off by the negative, as in the other case. I have taken photographs of two lamps, the latter being types of those which are in extensive commercial use in the United States, the one an open lamp showing shadows on the globe, the other the inclosed lamp with shadowless globe. The open arc lamp referred to was of the common 10-ampere type, operating at from 40 to 43 volts at the arc, with cored upper carbon 12.7 millimetres in diameter, and solid lower carbon 11.11 millimetres in diameter. The inclosed arc lamp was of the five-ampere type, operated at from 80 to 85 volts at the arc; solid upper and lower carbons 11.11 millimetres in diameter were used. You will note from the photographs that in the open arc the shadows on the globe are very marked, while the inclosed arc globe is shadowless.

In the case of the open arc, especially where cored carbons are used, the crater tends to center itself in the positive carbon. With the inclosed arc, however, the crater tends to wander; instead of issuing from a pointed negative tip located directly below the center of the positive, as is the case with the open arc, the arc stream of the inclosed arc issues from consecutive points along a flat surface, the crater in the positive always tending to be almost directly above

Inclosed Arc Lamp for Outdoor Use.

the point from which the arc issues. The area of the crater increases with the current strength; hence the greater the current density the less marked are the migrations of the arc. When carbons not larger in diameter than about 11 millimetres are used in the high-potential inclosed arc lamp, the wandering of the arc is not objectionable, especially when the diffusion obtained by the use of the inner bulb is marked. The lamp which I have burning here, you will note, is very steady; the diffusion of light is so perfect that the eye does not detect any motion of the arc.

CONCLUSION.

It will be noted that, in considering the commercial application of the inclosed arc light, attention has been concentrated on the adaptability of the lamp to direct-current, constant-potential circuits. The introduction of inclosed arcs on circuits of this class has been phenomenally great in the United States during the past year, the open constant-potential lamp being gradually relegated to the past. The field for the inclosed arc light, it is believed, will rapidly widen, the application to alternating-current circuits being already an accomplished fact, while the adaptation to constant-current, high-tension circuits will be simply a question of time. Summarizing, we may set forth the advantages of the commercial inclosed arc over the open arc as follows:

1. Cost of carbons, about one-twentieth of that of the open lamp.
2. Cost of attendance, about one-tenth of that of the open lamp.
3. The annoyance of daily trimming no longer an objection to the arc lamp.
4. Absence of shadows of the carbon points; uniform distribution of light.
5. One or more lamps on small amperage operated independently.
6. Cleanly; carbon dust entirely consumed.
7. Formation and escape of sparks prevented.
8. No flush of current at start or feed.
9. Simple lamp mechanism.

In conclusion, I desire most kindly to acknowledge the courtesy of those who have assisted me in the presentation of the subject this evening. I trust this society will also accept my sincere thanks for the honor conferred on me by the invitation to address you on the subject of "The Inclosed Arc Light." Naturally, it has been difficult for me to condense the experiences and researches of years into a short address, but I trust that I have thrown at least some light on the subject, and opened up the way to further research and development.

The Paris Exposition of 1900.

The Paris Exposition will open April 15 and will close November 5, 1900. Preparations are well advanced. The site will comprise the public grounds on both sides of the Seine from the Place de la Concorde, the great monumental square in the very center of the city, to a point beyond the Pont d'Jéna, embracing the Champ de Mars, the Trocadéro Palace and park (site of the exposition of 1889), the Esplanade des Invalides, the Quai d'Orsay, the Quai de la Conférence, the Cour la Reine, and a large section of the Champs Elysées, including the site of the Palais de l'Industrie, the great building erected for the International Exposition of 1855, the first of the series. No other city in the world contains, in its very center, an equal area available for a great exposition. Not only does this site leave nothing to be desired in point of convenience and accessibility, but, divided as it is throughout its entire length by the Seine, winding between magnificent quays and bordered by stately edifices and historic monuments, it lends itself admirably to the works of decoration and embellishment, in which the French people are past masters, and which are indispensable to a successful exposition.

All the details of the architecture are not yet worked out. The unique palace of the Trocadéro, erected for the exposition of 1878 and utilized a second time in 1889, will be used, as well as several of the great exposition halls of 1880 in the Champ de Mars, but all of them will undergo more or less modification. The Eiffel Tower will be preserved, but it is probable that some new and striking feature will be added to it. The Palais de l'Industrie, which housed the entire exposition of 1855, and in which the annual salon of the Société des Artistes Français is held, will disappear, however, and on its site will be erected a magnificent edifice to serve as the Fine Arts Hall during the exposition, and to remain as a permanent monument. Demolition is already in progress. To the west of the Fine Arts Hall, on the same side of the Champs Elysées, will rise the Hall of Liberal Arts, which is also to be a stately and permanent edifice. Between these great buildings will be constructed a broad avenue extending from the Champs Elysées to the Seine, at the point where a magnificent bridge is being constructed, named after Alexander III, Emperor of Russia, by whose son, the present Emperor, the corner-stone was laid, with imposing ceremonies, during his recent visit to Paris. This bridge will have a pronounced artistic character, and, with the projected avenue, will connect the Champs Elysées and the Esplenade des Invalides, adding a new and impressive vista to the charms of the famous Parisian avenue, with the stately golden dome which crowns the tomb of the great Napoleon in the background.

Consul-General Samuel E. Morss writes from Paris that the exposition will offer rare opportunities for American artists, inventors, manufacturers and workers in every field of human effort to illustrate once more to the world the vastness of our resources, the superiority of many of our industrial implements and processes, and the variety and excellence of our productions. It is hoped that American manufacturers and producers in all lines will be fully represented.

The classification of "Group No. 5, Electricity," is as follows:

Production and mechanical utilization of electricity.
Chemical electricity.
Electric lighting.
Telegraphy and telephones.
Different applications of electricity.

Electric railways come under the heading of "Tramways," in the transportation group.

MANUFACTURING NOTES.

Mr. J. J. Wood and Mr. C. C. Miller are conducting an invoice of the stock of the Siemens & Halske Electric Company at Chicago, in completion of the details of its consolidation with the Fort Wayne Electric Corporation.

The directors of the Akron, Ohio, Electrical Manufacturing Company have elected the following officers for the ensuing year: President and general manager, S. H. Pitkin; vice-president, F. A. Wilcox; treasurer, L. C. Miles; secretary, W. B. Doyle.

Discussing the "Business of a Great Factory" in the March *Scribner's*, P.G. Hubert, Jr., says, on the question of small economies versus profits: "A certain gigantic flour mill of Indianapolis ascribed a balance on the right side of the ledger one year to the fact that 10 hoops had been used on its barrels that year instead of 12, as in former years. Its margin of profit on a barrel of flour may be seen to have been small enough."

INCANDESCENT LAMPS.

ABSTRACT OF PAPER READ BY F. S. TERRY BEFORE THE NORTHWESTERN ELECTRICAL ASSOCIATION AT MILWAUKEE, JANUARY 20, 1897.

The making of an incandescent lamp requires more than 30 distinct processes, most of which affect its quality rather than its appearance. The character of the filament, the way it is flashed and the exhaustion may generally be said to have most to do in determining the quality, but the defect in a lamp may be traced to a defect in either the filament, the glass, the platinum, even the base, or due to poor workmanship in any one of the several processes in putting them together.

The electrical energy consumed in an incandescent lamp is transformed into light and heat. From three per cent to five per cent into light, the remainder—or from 95 per cent to 97 per cent—into heat. As light is the only useful product, the incandescent lamp may be said to have a real efficiency of from three per cent to five per cent.

An incandescent lamp may be operated at such a low voltage as to give heat, but no light. As the voltage is raised, the filament will become hotter and the proportion of light will be increased, and this may be continued until the heat is greater than the filament will stand, and it vaporizes. The filament that will stand the greatest degree of heat without vaporizing, other things being equal, is the best.

By increasing the voltage we increase the light more than in proportion to the increase in the energy consumed, and the lamp is then said to be more efficient. For example, a lamp giving 16 candle-power of light at 100 volts' pressure, and consuming 56 watts of energy, we would call a three and one-half-watt lamp. By increasing the voltage to 104, we raise the candle-power to 20, the watts of energy consumed to 60, and the watts per candle would be three, and we would then call it a three-watt lamp. If we should increase the voltage to 110, the candle-power would be increased to 28, the energy consumed to 70, the watts per candle would then be two and one-half, and we would call it a two and one-half-watt lamp. There is no difference in the lamp itself between what is termed a two and one-half-watt lamp and what is termed a three-and one-half-watt lamp.

As lamps are operated at a higher efficiency, their defects become more apparent. If one is satisfied to operate a lamp at an efficiency of six or seven watts per candle (and such lamps are made and sold), what is in reality a very bad lamp may give such a customer good satisfaction.

The life of an incandescent lamp will be shorter as it is operated at a higher efficiency, or, in other words, at a higher voltage. For example, if at three and one-half watts a lamp would have a life of 2,400 hours, at three watts it would, perhaps, have a life of 1,000 hours, and at two and one-half watts a life of 350 hours. It is not correct to take the life of an incandescent lamp as the measure of its quality. The practice of asking for guarantees of life has been nearly discontinued. The absurdity of such a guarantee is apparent when we consider that the conditions governing the life are under the control of the one operating the dynamo, and, further, the life of a lamp is a factor of small relative importance in determining any economy in incandescent lighting. Every manufacturer can make long-life lamps, and those that are inferior in quality will usually be found to have a long life.

The decline in candle-power is due to an increase in the resistance of the filament; consequently, it then requires a higher voltage to produce the same amount of light as at first. Every incandescent lamp will decline in candle-power after a certain number of hours' burning. If operated at a higher voltage or efficiency, the decline will be more rapid. The difference between different makes of lamps, as to the rate of decline, is due principally to the filament used and the exhaustion, and, when operated at the same efficiency, this rate of decline is the correct measure of their relative quality.

Sometimes central stations raise the voltage that they may give customers a better light or in order to burn out the old lamps. This is bad practice, as it will result either in burning out new lamps or reducing the candle-power until they will no longer give a serviceable light.

Lamps should be "smashed," as it is now usually termed, when they have ceased to give a satisfactory light, and should be replaced by new lamps of full candle-power.

The life of a lamp is usually understood to mean the length of time it will burn without burning out. It would be better to use the term "useful life," which would mean until such a time as the candle-power has declined, so as to give an unserviceable or uneconomical light, which, in most cases, would be so long as the light was within 25 per cent of the initial candle-power.

The term "efficiency of an incandescent lamp" usually refers to the initial efficiency, and as such does not signify very much. The real efficiency of a lamp is the average efficiency, being the light obtained for the energy consumed during its useful life.

The blackening of a lamp, as is well known, is due to particles of carbon that are driven off from the filament to the glass. This disintegration of the filament proceeds more rapidly when the lamp is operated at a higher voltage.

If a lamp bulb has become black, it is almost a sure indication that the lamp has been subjected to a higher voltage than was intended, or has been burning a good many hours. Blackened lamps should not be complained of as defective.

Probably there has not been an article written on the operation of incandescent lamps without calling attention to the importance of maintaining a uniform voltage, and still this is not fully appreciated in many central stations. The trouble is sometimes due to incorrect station voltmeters; sometimes to large pressure loss on the lines, and on alternating circuits may be due to poor regulation of transformers. Every central station should be supplied with standard portable voltmeters, and frequent readings should be taken of the voltage at different parts of the line. It must be remembered that overrunning a lamp not only shortens its life, but increases the resistance of the filament, so that it will not afterwards give its normal candle-power at the normal voltage. A fluctuating voltage must always result in an unsatisfactory lighting service. If it would be an advantage to the central station to have a higher efficiency lamp, the first step to take in that direction is better regulation, which will result in the lamps being of higher efficiency when operated at the normal voltage.

In a paper read at your last year's meeting, Mr. Buckley recommended the use of two and one-half-watt lamps, "and two-watt lamps if you can obtain them." You all have two-watt or two and one-half-watt lamps in your stations now. Just increase the voltage at which they are burned until the energy consumed, divided by the candle-power of light, gives you two and one-half, and you have a two and one-half-watt lamp. If you are using the best lamp, you will have the best two and one-half-watt lamp that can be made. If you wish a 16-candle-power, two and one-half-watt lamp, order of your manufacturer a lamp that will give you 16 candle-power at the voltage that you are operating, and will consume but 40 watts. Any lamp manufacturer can furnish such a lamp, although all would not give equal satisfaction. They would differ in quality the same as other lamps differ, but the defects in a lamp are more apparent when it is operated at a higher efficiency. Mr. Buckley gave some figures showing the saving made by using two and one-half-watt lamps. The figures given exaggerated the saving, as no allowance was made for the more rapid decline in candle-power of the two and one-half-watt lamps, which in practice will soon lose from 40 per cent to 50 per cent of their candle-power. The customer that wants a light of 16 candle-power will not be satisfied with one that gives but 8 or 10 candle-power, even if it may cost less to operate.

The two and one-half-watt lamp would not do at all on most central station circuits as they are now operated. When overrun in voltage they would be immediately burned out or the candle-power would afterwards be so low as to make the light unserviceable. A high voltage will injure so called high-efficiency lamps more than those of lower efficiency. With better regulation you can use higher efficiency lamps, and it is profitable to operate lamps at as high efficiency as will give satisfaction to your customers. Probably a three and one-half-watt lamp will give the best satisfaction in most moderate-sized stations as at present operated.

One difficulty in furnishing lamps to central stations is the lack of knowledge of how the station is operated. Often the voltage is higher or lower than is stated, due, perhaps, to an incorrect voltmeter, and lamps made for the voltage as ordered would not be satisfactory. Again the voltage may be irregular and a lower efficiency lamp would be more suitable. If all central stations were operated the same, it would be much easier to furnish a lamp that would always give satisfaction. This will perhaps explain how it is that a certain make of lamp is considered the best at one station and the worst at another.

One of the principal advantages of incandescent electric lighting over other forms of illumination is the readiness with which the electrical energy may be subdivided so as to give a light of such a candle-power as may be desired. This desirable condition is not in many central stations taken advantage of to as full an extent as might be profitable. Lamps can be obtained of from four candle-power to 500 candle-power. In some of the foreign countries the eight-candle-power lamp is the standard. In store lighting a bright light is wanted, and I predict that in the near future the standard for that service will be higher than at present, perhaps 20 candle-power. In residence lighting the demand is for a certain number of separate lights and that the monthly bills shall not exceed a certain amount. There are many places in residences where the smaller candle-power lamps, consuming less energy, will give as good satisfaction as the 16-candle-power. In decorative lighting and in sign work a small candle-power lamp, even as low as four candle-power, will give quite as good an effect as the 16-candle-power, and with about one-third the cost for energy. It is wasteful to put in a lamp giving more light than the conditions require.

The practice of using an old lamp that is low in candle-power in places requiring less light is not an economical one, as in most cases a new lamp giving an equal amount of light will save enough in energy to more than pay for the cost of the lamp. A lamp that has declined more than 25 per cent in candle-power should be thrown away—"smashed."

Managers of central stations frequently buy certain makes of incandescent lamps for the reason that they are one cent or two cents each lower in price, at the same time admitting that they are not quite so satisfactory in quality.

Some time ago I obtained from a number of electric lighting central stations statistics showing the capital invested and the results of their operation, and from an average of these I have made up some figures that I believe fairly represent the results that will be obtained in the average station.

We will take for our example a station having an investment of $100,000.

I found the average gross receipts of the stations above referred to was 26½ per cent of the investment, or this station should have a gross income of $26,500.

The average price charged customers for energy was 15 cents for 1,000 watt hours, which would be equivalent to three-quarters of a cent per lamp hour for a 50-watt lamp.

The electrical energy that this station would supply to customers in a year would, therefore, be 175,666 kilowatt hours.

Operating expenses, including general expenses, taxes and ordinary repairs for the year, $14,700, or about eight and one-third cents per kilowatt hour.

Now let us see what part of the cost of operating expenses is the item of lamp renewals.

A 50-watt, 16-candle power lamp we will assume will have a life of 600 hours, or the total consumption of energy of this lamp during its life will be 30,000 watt hours. If the cost of the lamps is 18 cents each, this will be equivalent to six-tenths of a cent per 1,000 watt hours, or seven and two-tenths per cent (about one-fourteenth) of the operating expenses, or, including the reserve fund, which is a legitimate item of the cost of operating, the cost of lamp renewals will be five per cent, or about one-twentieth of the total cost of energy.

Taking the total energy generated for the station referred to above, 176,666 kilowatt hours, and dividing by 30 kilowatt hours, the energy consumed by each lamp during its life, we find that this station would annually consume 5,888 lamps.

A difference in price of one cent per lamp would, therefore, amount in a year to $58.83, or one seventeenth of one per cent of the investment, or it would take 17 years for one cent, added to the price of lamps, to equal one per cent of the capital stock.

Are all incandescent lamps practically the same?

We know from experience, and from tests made, that they are not. Considering for a moment the lamp to be a device for generating heat, we would expect to find that two different makes would differ from each other at least one per cent, or if one lamp transformed 95 per cent of its energy into heat, we might reasonably expect another would transform 96 per cent into heat. These would not then differ from each other very much in their general conditions, but one would transform five per cent of its energy into light, and the other

four per cent, or in the amount of light produced for the same consumption of energy they would differ from each other 20 per cent.

If the customer pays three-quarters of a cent per lamp hour, and a lamp burns 600 hours, he pays for the energy consumed for that lamp during its life $4.50; and as light is the only product that is useful to the customer, a difference of 20 per cent in the amount of light obtained from two different lamps would be a difference in value to the customer of 90 cents.

I have seen tests of different makes of incandescent lamps showing even a greater difference than that stated above.

I remember, several years ago, being informed by one who had made a study of the operation of a number of large central stations, that those stations that were the most liberal in their lamp renewals were the most prosperous.

The use of a lamp that is inferior, I believe, will always result in reduced profits to the station, even if the lamp should cost nothing.

Electric Lighting Progress in New York—Kind Words for a Deceased Official.

We publish the following interesting extracts from the ably written report for the year 1896 of first vice-president R. R. Bowker, of the Edison Illuminating Company of New York city:

During the Spring an Electrical Exposition was held in New York, under the auspices of the National Electric Light Association, to which this company gave cordial support and in which it took a leading part. The exhibit of this company, which formed so distinctive a feature of the exposition, illustrated most fully the extraordinary range of application of the Edison low-tension current, and was a surprise to most of the citizens of New York, who, in large numbers, visited that exposition. The application of the current for heating and cooking purposes attracted special attention, and during the latter part of the year the development of this class of business has received increasing attention from the company's staff. An electrical kitchen is now in practical operation at the company's building, and can be seen on specified days in the week on application by letter. The development of apparatus for this purpose is in a more promising state than ever before, and its promoters are working in hearty co-operation with this company.

The development of the inclosed arc light, which requires trimming only once a week instead of once a day, is also proving of considerable advantage to this company, and it furnishes a method of lighting large interior spaces which is most economical as well as most effective.

During the past year the company has suffered its first severe loss by death in the ranks of its staff. Mr. Harrison J. Smith, who died June 18, 1896, from the effects of a fall while at his home, had entered the service of the company in 1881 as a working mechanic, and had been almost steadily in its employ from that date to the day of his death. He had won his promotion to the important and responsible position of general operating superintendent by keen self-education and persistent personal development, which made him of increasing value to this company. His pluck in facing emergencies, and his coolness under any circumstances, always inspired the men under him with corresponding qualities; and his practical qualities supplemented in the most admirable way the technical knowledge and training of other members of the company's staff. The sorrow at his death throughout the operating department, and in other divisions of the company with which he was less closely connected, gave evidence of the thorough way in which the interests of the company and its employés are now knit together. The staff of the company are joining in providing for a suitable memorial for Mr. Smith, toward which the company is also contributing.

Previous to Mr. Smith's death it had been proposed to promote Mr. J. W. Lieb, Jr., assistant general manager, to the post of general manager—a promotion which he had fully earned. Mr. Lieb was the first on the pay-rolls of the company at the old Pearl street station, leaving its service for the work in Milan, Italy, which occupied him until his return to the service of the company in 1894; and his wide experience and technical training have made him a most valuable officer of the company, not only co-operating with Mr. John Van Vleck, the constructing engineer, in the engineering development of the company, but keeping a careful oversight also of the operating department. This department had been so thoroughly organized before Mr. Smith's death, with capable superintendents in charge of each of the two districts, that it did not seem necessary to continue the office of general operating superintendent.

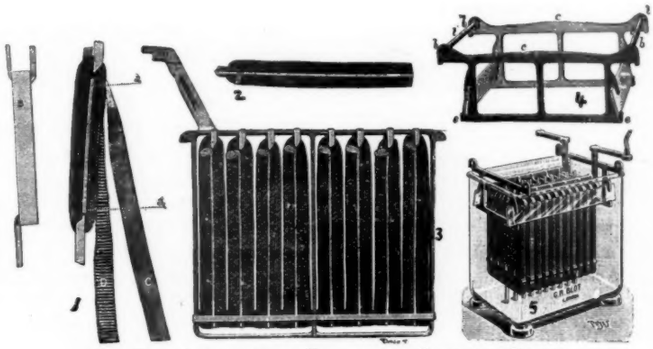
The Annual Dinner of the New York Press Club.

The New York Press Club held its annual banquet at Delmonico's, February 10. President Joseph Howard, Jr., entertainingly presided over the gathering of 200 diners. Among the speakers were Mayor Strong, Bishop Potter, Lieut. R. E. Peary, U. S. N.; District Attorney Olcott, Hon. William Berri, Hon. Charles S. Gleed, of Kansas, and Murat Halstead. The banquet was one of the pleasantest and most successful in the history of the club, and Mr. Charles J. Smith, chairman of the committee of arrangements, was the recipient of numerous congratulations.

Mr. W. C. Ballda, manager of the Utica, N. Y., Electrical Manufacturing and Supply Company, has closed a contract with the Walcott & Campbell Spinning Company, of New York Mills, for a complete modern lighting plant for their new yarn mill. The installation will consist of an 800-light Eddy incandescent dynamo, 45 of the celebrated Manhattan 150-hour inclosed arc lamps, and 262 Buckeye incandescent lamps, together with switchboard.

A New Accumulator.

The Blot accumulator is of the Plauté, or pure lead, type, containing no pasted oxide whatever. It is the invention of M. G. R. Blot, a French engineer. Its construction is based upon the suspension of alternately corrugated and embossed ribbons wound round a shuttle, the ribbons and shuttles varying in thickness, according to the electrical capacity and rate of charge and discharge required, and being so fixed as to be free to expand in an unoxidizable form. The rapidity with which these accumulators can be charged for traction purposes, also for motor-car work, was shown at a recent demonstration, and the simple construction of the plates and manner of their erection in cells was explained. The advantages claimed for the system are as follows: 1 Maximum electrical surface obtainable. 2. High rate of capacity and efficiency. 3. Rapid charge and discharge. 4. Immunity from buckling. 5. Absolute and efficient conductivity between active material and the frame. 6. Durability. 7. Low cost of production.



THE BLOT ACCUMULATOR—VIEW OF THE DIFFERENT PARTS.

In our illustrations Fig. 1 shows the method of mounting the corrugated lead ribbon D, and the embossed lead ribbon C, upon the shuttle, a completed shuttle being shown in side view at Fig. 2. Fig. 3 shows a completed plate. Fig. 4 the frame for suspending the plates in a cell, and Fig. 5 shows a completed cell. The Blot accumulator has been submitted to most severe and exhaustive tests, and is being introduced by the Blot Electrical Accumulator Company, of Bush Lane House, Cannon street, London. We are indebted to London *Invention* for the description of this battery.

The Armington & Sims Engine Company.

The Armington & Sims Engine Company, of Providence, R. I., will be heard from most noticeably in the steam field, now that Mr. Gardiner C. Sims has assumed active work as general manager of this widely known company. The efforts of Mr. Sims will be supplemented by the well known house of E. P. Hampson & Company, New York city, who continue to act as agents of the Armington & Sims engine. A number of detailed improvements, fitting this celebrated engine for modern practice in every respect, have been added. A number of very substantial orders have been placed for this engine, and the large factory at Providence presents a busy scene.

An Important Forthcoming Exhibition in New South Wales.

On the 26th of June a very important exhibition is to be opened in the Exhibition Building, Prince Alfred Park, Sydney, N. S. W. The exhibition will remain open during the months of July and August. It is intended to embrace engineering in all of its branches, and the exhibits will consist of raw materials, manufactured articles, machinery and models (in motion and otherwise), drawings and photographs of all kinds relating to scientific, mechanical and educational works in classified sections.

There will be no charge made for space allotted, but the executive committee reserves the right to limit the space of each exhibitor. The object of the exhibition is solely the advancement of engineering science and the promotion of a general and practical education therein. It will be non-competitive.

It is scarcely necessary to point out the advantages which will accrue to exhibitors in bringing their manufactures in such a prominent manner before the general public.

The exhibition will be under the patronage of His Excellency the Governor, the Right Honorable Viscount Hampden.

Among the various groups we notice—Group IV—prime movers, comprising steam engines, gas, electric, hydraulic, hot-air; water-wheels, turbines, wind-mills, steam generators, accessories of engines or boilers, etc.

Group V comprises machine tools, hardware, edge tools, cooking appliances.

Group VI comprises railway, tramway and vehicular appliances, and embraces rails, switches, signaling apparatus, locomotives, goods, wagons, carriages, etc., tramway cars, rails, permanent way, brakes, couplings, ticket-checking apparatus, bicycles, tricycles and auto-cars.

Electricity, Group IX, occupies an important place, and embraces generators, conductors, testing and measuring apparatus, telegraph and telephone apparatus, electric lighting apparatus, electro-metallurgy and electro-chemistry, transmission, distribution and utilization of power, lightning conductors, electro-thermic apparatus and electro-medical apparatus.

There are important groups also covering hydraulic machines, refrigeration, chilling and dairying appliances, educational appliances, drawings and photographs.

The exhibition will be exceedingly comprehensive, and as those held in 1883 and 1886 proved very successful, it is expected that this exhibition will be a greater success than the others.

The executive committee has appointed Mr. Edward Noyes, of Sydney, its representative in Europe and America for the purpose of obtaining exhibits. All communications on the part of intending exhibitors may be addressed to him, care of the Standard Air-Brake Company, 100 Broadway, New York, and they will receive immediate attention.

This opportunity gives our American manufacturers of electrical and engineering apparatus an excellent means of displaying their wares in Australia, as the exhibition will be very largely attended. It opens a favorable field for leading the way to sales in that enterprising country.

ADVANCE INFORMATION

New Electric Railways.

CLEVELAND, OHIO—The Cleveland & Eastern Electric Railway Company has been incorporated. Incorporators, D. H. Tilden, Chas. E. Fish, Roger M. Lee, Geo. H. Hopper, Chas. H. Taylor. Line will run from Cleveland to Omell on Pittsburgh, Youngstown & Ashtabula Railway.

WORCESTER, MASS.—It is expected that the Worcester & Marlboro street railway will be in operation by June 1. Another electric railway in contemplation is a proposed road from Northboro to Clinton, and this will connect through Clinton with Fitchburg, and another road is proposed to run from Fitchburg to Gardner. The contract for electrical equipment and apparatus for the Worcester & Marlboro road, amounting to about $50,000, has been given to the General Electric Company. The company will erect an 800-horse-power power-house at Northboro.

VICKSBURG, MISS. — Mr. Joseph Hirsh and Capt. J. J. Hayes, two prominent citizens of this place, have secured capital to construct an electric street-car service in this city.

BROOKFIELD, MASS.—The Warren, Brookfield & Spencer Street Railway Company have applied for franchise for an electric railway in the public street, from the North Brookfield branch railroad crossing at East Brookfield to the North Brookfield town line.

ANACOSTIA, D. C.—President A. E. Randle, of the Capital Railway Company, has filed with the commissioners an application for a permit to erect a trolley line along the tracks of the Anacostia Railway through this town to the south end of the Navy Yard bridge.

WEST NEWTON, PA.—The West Newton Northern Street Railway Company, connecting West Newton and Herminie, has been granted a charter. The directors are James E. Bell, cashier of the First National Bank, of West Newton; T. F. Vankirk and F. M. Null. The line will connect with Greensburg via the Hempfield branch of the Pennsylvania Railroad.

FREDERICK, MD.—The Myersville & Catoctin Railway Company, Reno S. Harp, secretary, will build a power plant to supply electricity for its railway.

NEEDHAM, MASS.—A franchise has been granted to the Newton & Boston Street Railway Company for a road from the Newton boundary, at Upper Falls, to the New England depot in Needham. Work on the road will be commenced in the Spring.

Increase of Capital.

SAN BERNARDINO, CAL.—The San Bernardino Electric Light Company will increase its capital stock from $50,000 to $100,000.

ST. LOUIS, MO.—The County Electric Light and Power Company will increase its capital stock from $20,000 to $50,000, and erect a new electric power plant.

New Construction Company.

WASHINGTON, D. C.—The Capital Construction Company has been incorporated, with W. E. Saunders, president; P. McK. McBaldwin, secretary; W. H. Saunders, treasurer, and Robert Portner, Park Agnew, J. M. Johnson and J. T. Johnson, incorporators, to buy, sell and improve real estate in this State and the District of Columbia. Capital stock, $100,000.

New Manufacturing Companies.

CHICAGO, ILL.—The Evans Electric Company has been incorporated. Capital stock, $2,500. Incorporators, Andrew J. Evans, Walter Simpson and Theron Durham.

STANDISH, MICH.—Standish Electric Company has been incorporated, with a capital stock of $20,000.

FOSTORIA, OHIO—B. G. Tremaine and associates, of Cleveland, will erect a factory for the purpose of manufacturing incandescent electric lamps. The company will have an authorized capital of $100,000.

Electric Light and Power.

TROY, OHIO—City Clerk may be addressed concerning contemplated municipal electric light plant.

ORION, ILL.—Village Trustees contemplate the purchase of defunct creamery plant for purpose of converting it into an electric light plant.

BIG RAPIDS, MICH.—The Farrman Electric Light and Power Company has been incorporated, with a capital stock of $15,000.

MAXTON, N. C.—An electric light plant is to be established.

VALLEY JUNCTION, IOWA — An electric light plant is in contemplation.

WORTH WALES, PA.—Muir & Hall, of Philadelphia, will operate an electric plant in this town.

FINN'S POINT, N. J.—An electric light plant will be established.

BARABOO, WIS. — Several citizens are pledged for enough money to put in an electric light plant valued at $20,000, and the City Council will be asked for a franchise.

LANSING, MICH. — The agricultural college will ask the State for $11,000 this year, so that an electric lighting plant may be built.

PEORIA, ILL.—A petition has been presented to the Village Board of Maquon by F. L. Jones for a franchise to have the exclusive right to establish and operate an electric light and power plant.

BELLBUCKLE, TENN.—The Bellbuckle Telephone and Electric Light Company will be organized to erect electric light plant and establish telephone system.

CHARLESTON, S. C.—The Charleston Street Railway Company, recently reported as to erect a power-house, will also put in an equipment for supplying the city with electric lights. The entire improvements will probably cost about $1,000,000.

DALLAS, TEX.—T. L. Lawhon, City Secretary, may give information concerning proposed erection of electric light plant.

EXCELSIOR SPRINGS, MO.—The Excelsior Springs Gas and Light Company has been incorporated by R. L. Yeager, A. R. Strother and J. B. Forbis, Jr., with a capital stock of $2,000.

OKOLONA, MISS.—An electric light plant and waterworks are to be constructed, and the W. T. Adams Machine Company, of Memphis, Tenn., has received contract for the machinery for same.

GRENADA, MISS.—The Mayor may be addressed for information concerning construction of electric light plant.

MALDEN, MO.—G. W. Peck, Mayor, may be addressed concerning erection of electric light plant.

CLARKSVILLE, TENN.—The Mayor may be addressed for information concerning the establishment of an electric light plant.

VAN BUREN, ARK.—The Mayor may be addressed concerning erection of an electric light plant.

JACKSONVILLE, FLA.—Superintendent Patterson will recommend the expenditure of $20,000 for increasing the capacity of the electric light plant one-third.

ROME, GA.—The Rome Lighting Company has been incorporated by J. L. Bass, R. J. Ragan, S. S. King and others for the purpose of erecting electric light plants, etc. Capital stock will be not less than $20,000 nor more than $100,000.

MAXTON, N. C.—A. J. Cottingham is investigating electric lighting, with a view of erecting an electric light plant.

GRAHAM, VA.—J. B. Greever may be addressed concerning construction of electric light plant.

REDWOOD FALLS, MINN.—A. C. Burmeister has been granted franchise to construct and operate an electric light plant in this city.

SALISBURY, MD.—Philadelphia capitalists will erect an electric light plant.

BARTOW, FLA.—W. H. Towles is putting in an electric light plant, which will be in operation in less than 60 days.

RUTLAND, VT.—City Clerk may give information concerning establishment of a municipal light plant.

New Telephone and Telegraph Companies.

LANCASTER, KY.—J. B. Kinnaird will establish a telephone system at this place.

COHOCTON, N. Y.—The business men of this place, North Cohocton and Atlanta are forming a stock company for the purpose of connecting the three villages together by telephone. A good share of the stock has already been taken.

NATCHEZ, MISS.—The Natchez Telephone and Telegraph Construction Company has been incorporated with the following officers: W. P. Stewart, president and general manager; L. P. Conner, vice-president; Dr. J. C. French, secretary and treasurer; directors, J. P. Butler, J. C. French, A. G. Campbell, G. F. Green, J. N. Carpenter, R. F. Learned, L. P. Conner, Joseph Reale, J. A. Clinton, J. G. Smith, James Farrell, W. P. Stewart.

NACOGDOCHES, TEX.—The telephone line from here, via Melrose and Chireno, to San Augustine, 30 miles east, is about completed. It was built by a stock company under the leadership of Mr. John T. White. He will now endeavor to extend it to Alto, 27 miles west of here.

The Electro-Chemical Industry.

The actual production by electrolytic methods of either chemicals or metals is less in Great Britain than in either America or Germany, says London *Engineering*. One chlorine and soda factory has started on a large scale at Helens, but there have been so many accidents to their turbines and dynamos that very little of their product has been put on the market; the Hargreave process for producing chlorate of soda is working satisfactorily at Norwich; the Castner-Kellner works at Weston Point are progressing, but nothing has been produced; three aluminum works have been started in England during the last five years, but have been stopped owing to the rapid fall in prices, and none of them are working at present, although the works at the Falls of the Foyers will be in operation next year.

In France, Germany and Switzerland there is a much more flourishing condition of affairs, due partly to their water powers and to their better trained scientists. All of the undertakings appear to be prosperous. In Norway great preparations are being made for utilizing the waterfalls. The most successful development of electro-chemical and electro-metallurgical industries is in the United States. The whole number of plants for electrolytically refining copper is 20. There is only one company producing aluminum, and one or two at Niagara Falls for producing chlorate of potash. Chlorine and soda are made at Saltville, Va. The Siemens & Halske gold-extraction process is most promising, and it is used by eight mining companies in Africa, who treat 60,000 tons of tailings monthly. This may quite displace the old zinc-precipitation process.

HOW TO WIRE BUILDINGS

The Book for Wiremen, Electrical Engineers, Contractors, Constructing Engineers, Architects and Students. 162 Pages. Illustrated. Price, $1.50. Sent to any address on receipt of price. Electrical Review Pub. Co., 41 Park Row, New York.

Kindred.... ...Interests

Fred M. Locke, Victor, N. Y., is having an unusual demand for the high-potential "Locke" insulators, and is now manufacturing these insulators in many forms. This insulator is coming into very large use.

The Metropolitan Electric Company, of Chicago, report a good trade for the month of January, the volume of business done for the month being considerably greater than for the month of December.

The Clonbrock Steam Boiler Company, Brooklyn, N. Y., manufacturers of the well known Morrin Climax steam boilers, will send their new and very complete catalogue to all applicants. Every steam user should have a copy of this catalogue. It is worth sending for.

The Electric Appliance Company, of Chicago, are at present distributing two very neat and tasty circulars of some of their specialties and staple goods, one circular being devoted to porcelain tubes and insulators and the other to sparkless and Bordreaux dynamo brushes. In connection with the circulars, the Electric Appliance Company are quoting a revised discount on these goods, low enough to warrant the assurance that considerable business will result. They will be pleased to send circulars and quote discounts where they have not already been received.

The Colliery Engineer Company, Scranton, Pa., proprietors of The International Correspondence Schools, announce that, commencing with the February issue, the name of the journal, *Home Study*, which they publish, will be changed to *Home Study Magazine;* the page will be reduced to magazine size, but the number of pages will be doubled. The articles relating to particular branches of industrial science will be grouped in separate issues. Articles relating to steam engineering will be published in the February and August issues; those on electrical engineering, in the June and December issues. Each issue will contain other articles, but, as a rule, the general reading portion will consist principally of articles on some particular technical subject.

The Central Electric Company has taken the agency for the new Benjamin waterproof socket. This socket, designed by a man of many years' experience in construction work, and particularly work pertaining to street railroad operation, is all that its name implies. It is so constructed as to be attached directly to a 7–16 or 9–16 iron-armored conduit, has sufficient metal in its shell to stand a great amount of very hard usage, and wherever used has easily proven its superiority. This company has also taken the western agency for the Wagner alternating-current ceiling fan motor. This motor is constructed on radically new lines and has many new commendable features. Notably, it is absolutely noiseless in operation, and consumes 120 watts when running at normal speed of 125 revolutions per minute; is guaranteed to produce an external agitation of the atmosphere without producing the same result on the purchaser. The company is having a constantly increasing demand for the ironclad theater dimmers. The compact design of this apparatus and its ability to rapidly dissipate heat commends it for use under all exacting conditions.

An Electric Coffee-Pot.

This week the American Electric Heating Corporation, of Boston, announce the addition of a French coffee-pot to their line of domestic utensils. In the past, such articles have been made with the electric heater permanently attached to the device, thereby making it necessary to have a number of complete outfits to do a limited amount of work. The coffee-pot above referred to is made to fit a four and one-half-inch disk heater, and is of ample size for the wants of four people; is made of block tin and so designed that all of the heat generated in the stove is used. Two of the $4 stoves, with a stew-pan and coffee-pot, will enable a family to cook a breakfast of coffee, toast and eggs in the time required to build a fire and get the ordinary stove ready.

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Care ELECTRICAL REVIEW, New York.

Mardi Gras—New Orleans.

The Southern Railway, the direct line between New York and New Orleans, announces one fare round-trip rates from Washington to New Orleans. Tickets for sale on February 26 to March 1, inclusive, and good to return within 15 days from date of sale. The time between New York and New Orleans is 39 hours, and the service is perfect in every respect. Dining and sleeping cars on the limited trains. For further information, call on or address New York Office, 271 Broadway.

Stop-over Privilege at Washington.

A 10-day stop-over at Washington, D. C., is now granted on all through tickets between the East and West, via B. & O. Railroad. Stop-over will also be granted on return journey made on round-trip tickets, within the final limit of such tickets, but not exceeding 10 days. Passengers will deposit their tickets with the ticket agent at B. & O. Railroad station in Washington, who will retain them until the journey is to be resumed, when they will be made good for continuous passage to destination by extension or exchange. This arrangement will doubtless be greatly appreciated by the traveling public, because it will permit the holders of through tickets to make a brief visit to the National Capital without additional outlay for railroad fare.

Electrical Manufacturers, Attention!

Messrs. Toomer, Nunn & Co., Calle de Gante 8, Mexico City, Mexico, are contractors for all classes of electrical work, and for building electric light plants, telephone and telegraph lines, etc., throughout the Mexican Republic.

They desire the names of manufacturers of electrical apparatus and supplies in the United States.

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Manufacturers interested should write promptly to the above address.

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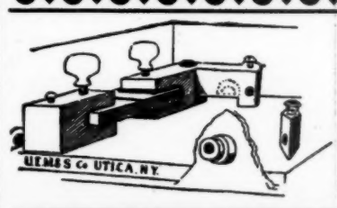

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Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED FEBRUARY 9, 1897.

576,545. Apparatus for electrically heating metal; G. D. Burton, Boston—A vessel for containing an electrolytic solution, a hearth composed of two members for supporting a metal to be heated, one of said memoers being movable relatively to the other, and means for moving one of said members relatively to the other.

576,551 Telephone transmitter; M. E. Clark, Minneapolis, Minn.

576,577 Telephone system; A. S. Hibbard, Chicago, Ill.

576,621 Electric switch; M. Schalscha, Hoboken, N. J.—A switch adapted to be carried by a moving device to regulate the current through a motor for said moving device, comprising a switch in the electric circuit and having a series of contact plates, a switch-arm for closing the circuit through the plates, a rotary shaft on which said arm is mounted, a rotary shaft having gear connection with the arm-carrying shaft, and arms extended radially from the last-named shaft.

576,622 Electric locomotive and railway system therefor; M. Schalscha, Hoboken, N. J.

576,710 Ventilated fuse plug for electric circuits; H. C. Wirt, Schenectady, N. Y.—A hollow ventilated fuse plug for fuse circuits, having a metallic contact ring surrounding its sides, and a metallic contact portion at its lower end, a recess in its upper portion provided with a bridge, and a fusible wire having its ends connected to the metallic terminals and curved over said bridge.

576,720 Galvanic battery; H. J. Brewer, New York, N. Y.

576,721 Trolley system; W. G. Caffery, Reno, Nev.—A positive and negative conductor arranged in a vertical plane, one above the other, and a trolley to travel in contact with the conductors and consisting of pivoted bars forming an extensible and contractible frame, slotted plates in which the frame bars are guided, contacts carried by the plates and removable arms pivoted to the plates and carrying contacts, said arms being provided with springs for holding their contacts up to the conductors.

576,766 Electric heating apparatus; A Robertson, Taunton, Mass.

576,804 Telephone apparatus; C. E. Buell, North Plainfield, N. J.—A charged line, an annunciator in said line, normally open connections from said annunciator to a switchboard, equalizing resistance between said annunciator and a charging generator, a continuity preserving key between said annunciator and a charging generator, and a normally connected storage battery joined to said generator.

576,813 Telephone transmitter; J. F. Gilliland, Adrian, Mich.—Saucer-shaped electrodes provided with a groove about the facing edges of a resilient non-conducting ring located in said grooves, granular conducting material confined between said electrodes, and opposite axial bearings for supporting the united electrodes.

576,854 Station indicator; J. D. Keen, Louisville, Ky.

576,933 Electric lighting for vehicles; J. A. Ageron, Paris, France.—An automatic circuit-breaker consisting of a rotatable hollow body adapted to contain a conducting fluid and constructed of two sections of conducting material insulated from each other.

576,936 Battery; F. B. Badt, Chicago, Ill.

OUR CANADIAN LETTER.

DUNDAS, ONT.—The rate-payers desire to secure the installation of an electric light plant.

SUNDRIDGE, ONT.—Mr. Irving intends putting in an electric light plant in his woollen mill.

STURGEON FALLS, ONT.—The rate-payers voted a by-law for the purchase of an electric light plant.

KNOWLTON, QUE.—The electric light company propose putting in a new plant here this Spring.

PARRSBORO, N. S.—A local company is being organized here to put in a plant for electric street lighting in the Spring.

BELLEVILLE, ONT.—A scheme is on foot to extend the electric railway west from Belleville to Trenton, and thence north to Tweed.

HALIFAX, N. B.—The City Engineer has been instructed to report on the cost of installing an electric light plant to do the city lighting.

ROSSLAND, B. C.—A Montreal syndicate is said to have purchased the water and light plant and franchise, and propose putting in a complete electrical system.

HAMILTON, ONT.—The International Radial Railway Company will make an application for a bonus of $65,000 towards the construction of an electric railway to Guelph.

CHATHAM, ONT.—The promoters of the proposed Chatham City & Suburban Electric Railway will apply to council for an extension of their franchise to include electric lighting.

FREDERICTON, B. C.—The City Council have still under consideration the purchase of a road plant. A proposition has been made to the council to install an electric fire-alarm system.

PORT ARTHUR, ONT.—The street railway company will likely put in a plant in the power-house for the lighting of the town to consist of a dynamo capable of running 1,300 16-candle-power lights.

QUEBEC, QUE.—The Trades and Labor Council have requested the City Council to grant a contract for street lighting for two years only, at the expiration of which time it is urged that the city install an electric light plant.

NIAGARA FALLS SOUTH, ONT.—M. A. G. Hanan and Ed Davis, of Niagara Falls, have secured the control of the Niagara Falls, Clifton & Drummond Street Railway, and will probably convert it into an electrical system in the Spring.

ROSSLAND, B. C.—A company of eastern capitalists have been formed to build an electric railway between Rossland and Spokane, a distance of 160 miles. It is likely that the Rossland branch will be built this year, but steps will be taken at once to build that portion of the road from Spokane to the boundary line.

NELSON, B. C.—A company has been organized, with a capital stock of $20,000, to put in an electric light plant. The work of the construction will be commenced as soon as the water rights are obtained from the government. The company will order one 5,000-light machine, step-up and step-down transformer, long-distance system that will supply 2,200 volts in town; also one 50-light arc machine. George Cassidy, of Vancouver, will probably establish a sawmill here.

J. A. C.

Montreal, February 11.

Wanted—An Idea Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write JOHN WEDDERBURN & CO., Patent Attorneys, Washington, D. C., for their $1,800 prize offer and list of two hundred inventions wanted.

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REFERENCES: "Electrical Review," New York; Paul Cromlein, Teller Lincoln National Bank, Washington, D. C.; Judge Geo. D. Parker, Berkley, Va.; Second National Bank, Washington, D. C.; E. K. Leech, U. S. Mint, Philadelphia, Pa.; W. F. Newell, Manager and Secretary Water Works, Olympia, Oregon.

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